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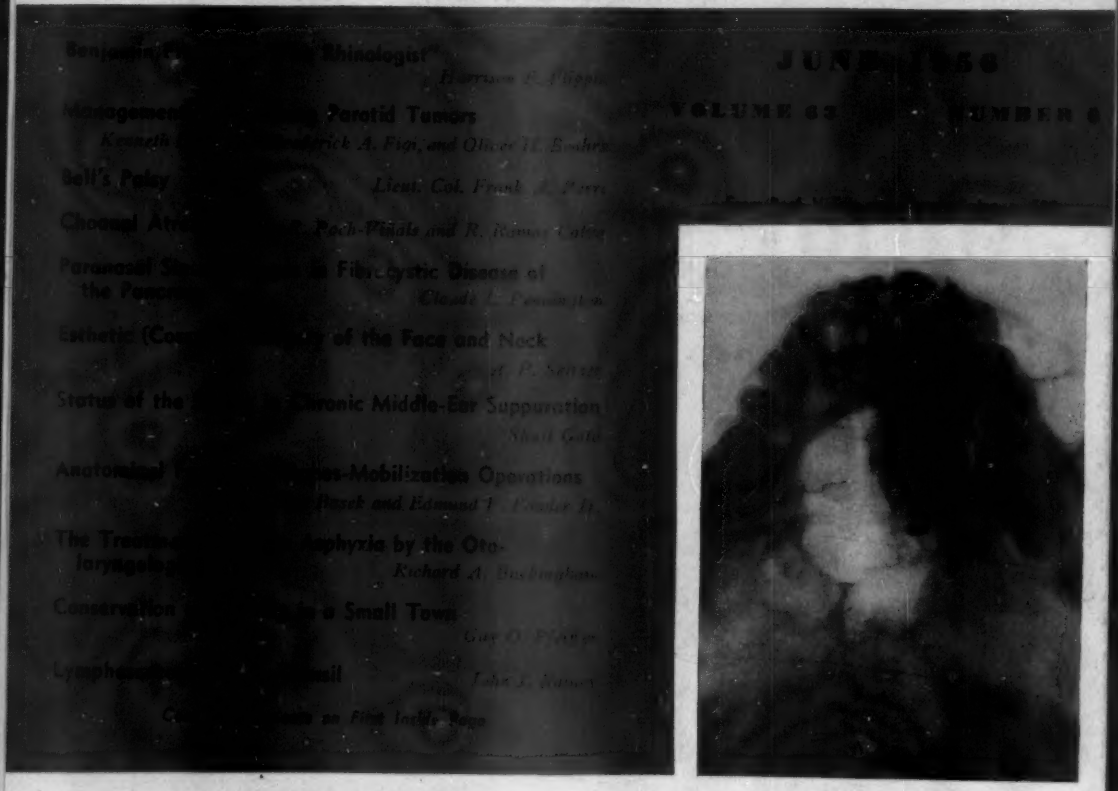

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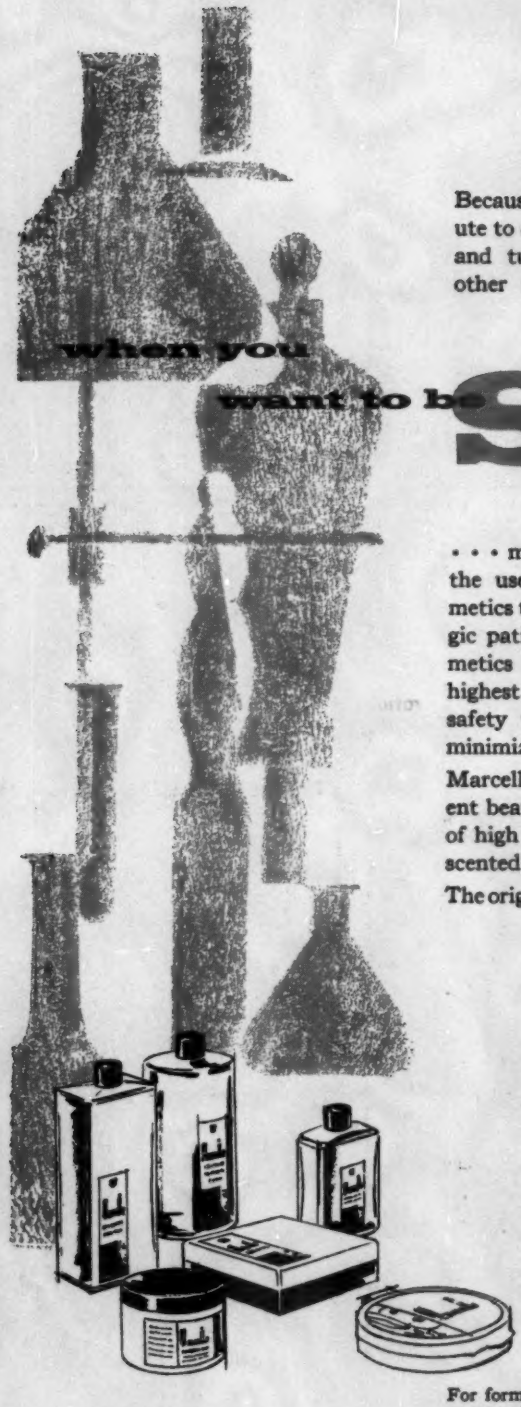

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JUNE 1956
VOLUME 63 NUMBER 6

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FOR THE PERIOD
JANUARY THROUGH JUNE, 1956

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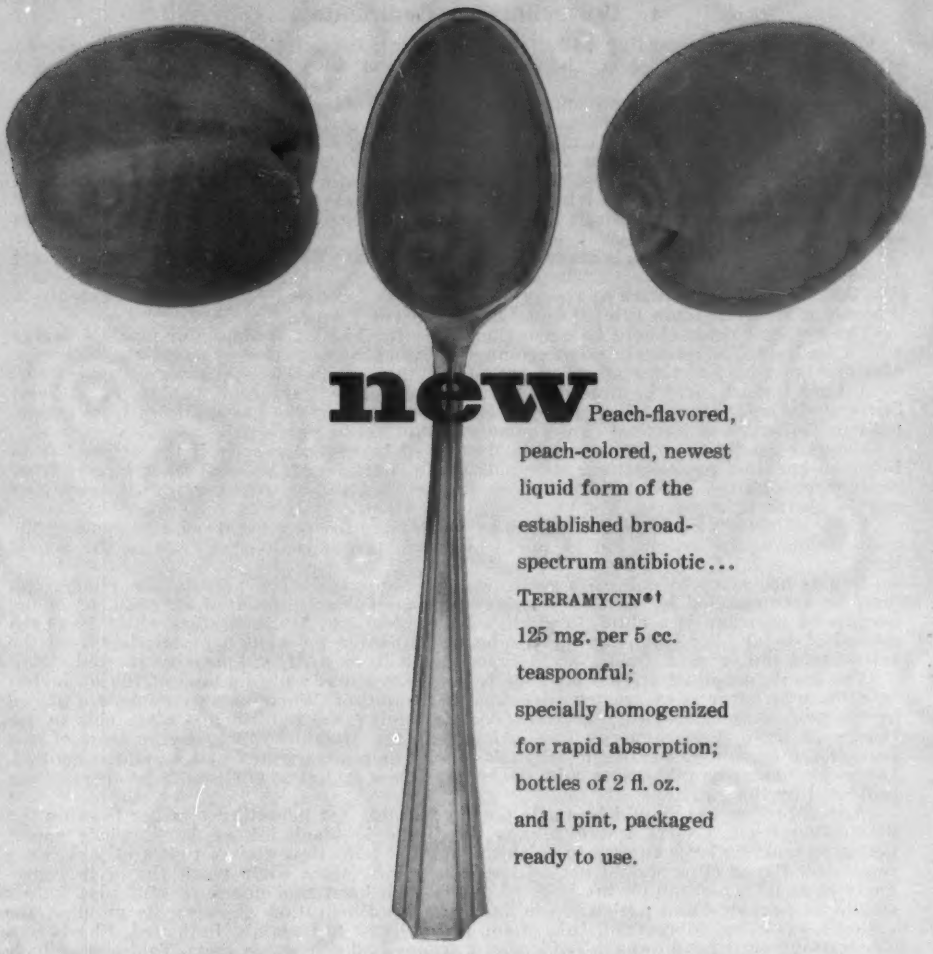

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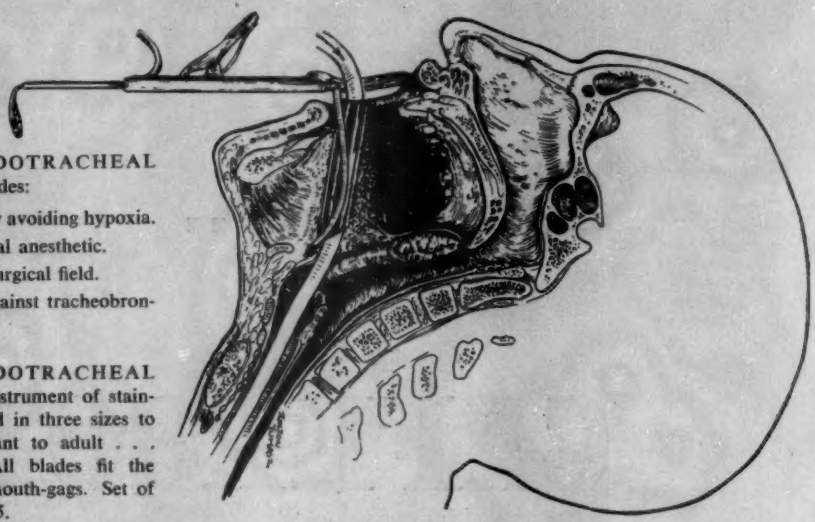

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Benjamin Franklin — "The Rhinologist"

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This year, we commemorate the 250th Anniversary of the birth of Benjamin Franklin, who had one of the broadest as well as one of the most creative minds of his time. The scientists of the 18th century, unable to experiment and too absorbed in logic, admired him for his practical and realistic talents. Among these were his medical theories, which received much recognition, particularly his theory on the origin of colds and their complications. No doubt his interest in colds was stimulated by the fact that in his early twenties he suffered on two occasions with pulmonary abscesses following the contraction of a cold. He observed that people seldom caught cold from exposure to air, or even dampness, stating that Indians and sailors who are continually wet never caught colds, nor is cold taken by swimming. Franklin thought that a cold was caused, in most cases, by impure air. He wrote so well and so prettily on colds that people began to think that he was the discoverer of their causes, but it would seem that he merely collected and expressed the observations of others, as well as his own. None of them were entirely new, and many of them are now considered unsound; however, he was one of the most prominent advocates of ventilation and was an authority on it, being appointed, while in England, to prepare a plan for ventilating the Houses of Parliament. In fact, he was so enthusiastic about fresh air that, in the opinion of his own physician, he was sacrificed to his own theory, having caught a violent cold which finally choked him, by sitting some hours at a window with a cool air blowing upon him.[1]

During the same period in which he was commenting about colds, he explained the laws of hot air and its movements, pointing out that the stoves then in use had no ventilating properties and, in order for the smoke to escape, the doors must be opened, which created a draught. This observation led to his invention of the "Pennsylvania Fireplace." Having familiarized the laity of the time with the potential dangers of draughts, he wrote, in an advertisement for his new stove, "women particularly suffer from this cause, as they sit much in the house, get colds in the head which fall into their jaws and gums and have destroyed many a fine set of teeth in the Northern Colonies."[2] Certainly, Franklin's excursions into the domain of medicine are not, therefore, to be considered among his most valuable contributions to the welfare of man, except insofar as they encouraged him to advocate fresh air and ventilation and to demonstrate his familiarity with the transmission of infection from the sinuses to the teeth.

That certain complications followed profuse nasal and postnasal discharges was known many years before Franklin.[3] In 1674, Riverius, physician to the King of France, wrote: "When the humor flows upon the

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Professor of Clinical Microbiology, The Graduate School of Medicine, The University of Pennsylvania.

breast, the disease keeps the general name of a catarrh . . . when it falls upon the jaws, it is called bronchus; when it flows into the nostril, it causeth not only a coryza, but ozena. But, in other parts it produces various effects . . . therefore, it is rightly conceived that the greatest part of diseases that trouble man's body have their original from the head."[4] Although Riverius attributed many diseases to this cause which have since been proved to be caused otherwise, the fact remains that today, especially in this time of year, approximately 75% of all bacterial infections encountered by the practicing physician are related to disease in the upper respiratory tract.

Certainly, a great deal has been learned about disorders of the head since Franklin's time. Today it is possible to establish the existence of many types of pathologic and physiologic disorders in the upper respiratory tract by virtue of various tests and procedures. Of especial interest is the fact that we are able to establish the existence of infection by microscopic identification of bacteria, direct visual observations for the presence of pus and obstruction, and x-ray, which helps to locate the specific area of involvement. In addition, we have available effective antimicrobial agents of great diversity, whose sphere of activity encompasses most of the pathogens involved in these infections. However, in spite of these advances in diagnosis and treatment, we cannot fail to be cognizant of certain definite limitations which still exist in the management of upper respiratory tract infections and their complications. Obviously, this situation is incapable of improvement unless the factors contributing to the development of such infections, as well as those responsible for therapeutic failures, are known and understood. Unfortunately, time does not permit a systematic analysis of these problems, but I may discuss briefly some of the basic principles involved in the management of such infections with the now available antimicrobial agents.

ANTIMICROBIAL AGENTS

Although modern antimicrobial therapy had its beginning less than a century ago, with the bacteriological discoveries of Pasteur and Koch and the prophylactic use of chemical agents for septic wounds by Lister, it was the clinical application of chemotherapeutic substances by Ehrlich which opened the gates leading to the present status of antimicrobial agents. It was Ehrlich who conceived of an antimicrobial agent as one capable of destroying the offending agent within the tissues of the body and at the same time of sufficiently low toxicity not to harm the host. Likewise, he emphasized that certain organisms could acquire resistance to antimicrobial agents and that the resistance of some organisms was an inherent characteristic. Although Ehrlich's dream of an ideal antimicrobial agent has as yet not been fully realized, the results which are now being obtained with these agents in the treatment and prevention of many types of infections probably surpass Ehrlich's most optimistic expectations. This has been brought about largely as a result of two outstanding developments, namely, the synthetic antimicrobial agents, such as the sulfonamides, aminosalicylic acid, isoniazid, and nitrofurantoin, and those products that are biosynthesized by micro-organisms, the antibiotic agents.

These anti-infective agents have completely revolutionized the practice of medicine, but with mixed results. The conquest in the control of infections may be considered a wonderful triumph, but at the same time one must not forget that this triumph has been tinged with tragedy, in that certain undesirable consequences often follow the use of these agents.

Sulfonamides.—Within a relatively short period after the introduction of sulfanilamide and its allied compounds, certain shortcomings were apparent; first, many strains of bacteria are naturally resistant to their action; second, initially susceptible strains in a species can and do develop resistance to the sulfonamide drugs during treatment, so that a number of bacterial infections are no longer amenable to sulfonamide therapy; third, these drugs may produce a variety of serious untoward reactions, and, fourth, the antibacte-

rial activity of the sulfonamides is diminished in the presence of pus. Because of these disadvantages and with the introduction of the antibiotics, indications for the sulfonamides became greatly restricted. Nevertheless, within the past several years, there has been a renewed interest in their use, largely as a result of the toxic reactions associated with the antibiotics. At this time the N^1 heterocyclic derivatives of sulfanilamide, the sulfapyrimidines (sulfadiazine, sulfamerazine, and sulfamethazine), by virtue of their superior antibacterial efficacy and relatively low toxicity, are generally recognized as the most satisfactory of the sulfonamides for the treatment of susceptible systemic infections. In addition, such compounds as sulfisoxazole and sulfadimetine, and others, because of their increased solubility in urine and relatively higher concentration, are primarily reserved for the treatment of urinary tract infections. Likewise, as a result of their poor absorption from the gastrointestinal tract, phthalylsulfathiazole and succinylsulfathiazole are employed in infections of the gastrointestinal tract. In general, there is little qualitative difference in the antimicrobic spectrum of the various commonly employed sulfonamides. The most susceptible types of organisms include streptococci, staphylococci, pneumoeocci, gonococci, meningococci, Escherichia coli, and Hemophilus influenzae. The sulfonamides can be employed alone or as mixtures or in combination with the antibiotics.

Other synthetic antimicrobial agents included in this group are two drugs, aminosalicylic acid and isoniazid, which find their greatest usefulness as adjuncts in the treatment of tuberculosis. In addition, nitrofurantoin is employed in urinary tract infections.

Antibiotic Agents.—Since the observations of Pasteur and Joubert, in 1877, it has been known that certain micro-organisms are capable of inhibiting the growth of other micro-organisms, which phenomenon is called microbial antagonism. The inhibiting action of one organism upon another has been shown to be due to the production of certain metabolic antibacterial products on the part of the antagonistic agent. In 1940 penicillin was shown to be such an agent, and, although many other antibiotics have been introduced since that time, penicillin still remains the sheet anchor of antimicrobial therapy. Unlike the sulfonamides, penicillin is effective in the presence of pus, and, with certain questionable exceptions, no organisms have been shown to develop a significant degree of resistance to penicillin during its administration. The organisms most susceptible to penicillin include the pneumococci, streptococci, staphylococci, certain of the clostridia, and strains of Lactobacillus. In addition, the Gram-negative cocci, meningococci, and gonococci are sensitive to this drug. Treponemal and borrelial infections can also be successfully treated with penicillin.

Streptomycin was introduced for clinical use in 1944. In contrast to penicillin, it possesses antibacterial activity against both Gram-positive and Gram-negative organisms and is of particular importance against the tubercle bacillus. By virtue of its antitubercular properties, streptomycin remains a uniquely valuable drug and should, for the most part, be reserved for the treatment of tuberculosis. However, streptomycin is still employed in other selected cases, either alone or in combination with other antimicrobial agents.

The Broad-Spectrum Antibiotics.— The expression "broad-spectrum antibiotics" is used to designate certain of the antibiotics which possess activity against a great variety of micro-organisms in contrast to the antibiotics, such as penicillin, with a narrow spectrum of activity. Experience has indicated that the wider the spectrum of activity of an antimicrobial substance the greater is the toxicity and the less the specificity of action. Fortunately, the now-available broad-spectrum antibiotics are of sufficiently low toxicity to permit their administration in man and are effective in infections caused by bacteria, rickettsiae, and certain viruses. Because of their pharmacological properties, the broad-spectrum antibiotics, unlike streptomycin, can be administered successfully by mouth. Chloramphenicol, the first of these broad-spectrum

antibiotics, has found its chief usefulness against organisms of the Salmonella group, especially that causing typhoid fever. Because of the possibility of the development of blood dyscrasias in patients in whom it is employed, it is not recommended for general use. However, it remains a valuable therapeutic agent in selected cases. The tetracycline group of antibiotics is composed of chlortetracycline, oxytetracycline, and tetracycline. In general, there appears to be little difference as far as therapeutic effectiveness is concerned between the three members of this group, although some differences may exist. Erythromycin is considered a member of the broad-spectrum group, although its greatest usefulness is in the treatment of infections due to staphylococci, streptococci, pneumococci, and organisms resistant to penicillin. Although polymyxin B sulfate is an agent of considerable toxicity, its unique effectiveness in infections due to Pseudomonas aeruginosa has justified its introduction into clinical practice. This agent should be employed parenterally only in hospitalized patients, since careful observation for renal damage is essential to its safe use. Since the parenteral administration of bacitracin is often followed by kidney damage and only a small amount is absorbed when given by mouth, this drug finds its chief usefulness as a topical or oral medicament. Since neomycin is not absorbed into the blood stream from the gastrointestinal tract or skin, it has found its chief usefulness in preoperative preparation for intestinal surgery and as a topical medicament for pyogenic skin infections. When administered systemically, neomycin may cause slight to severe deafness, as well as transient renal irritation. However, in selected cases, especially in Proteus and Pseudomonas infections, it may be administered intramuscularly for short periods of time.

ANTIMICROBIAL THERAPY OF UPPER RESPIRATORY INFECTIONS

The selection of the appropriate agent, or agents, for use in a specific infection is an intricate problem. The site of infection, the nature and number of infecting agents, and their antibacterial susceptibility must be considered. While many bacteria have at one time or another been implicated in upper respiratory tract infections, only a small number occur frequently and repeatedly. The great majority of such infections are caused by pneumococci, streptococci, and, to a lesser extent, staphylococci, meningococci, and H. influenzae.

Theoretically, one should isolate the causative organism and determine by sensitivity tests the most suitable antibiotic in each case. However, this Utopian situation is impossible for the busy practitioner, and there is some question whether such an approach is necessary.[5] Certainly, most infections of the upper respiratory tract can be accurately diagnosed from the clinical manifestations of the disease. However, in some cases, especially those involving bone and/or mixed infections, it is important to employ the necessary laboratory tests in order to select the proper antimicrobial agent, or agents. Both the β-hemolytic streptococci and the pneumococci are extremely sensitive to penicillin, the tetracyclines, erythromycin, and chloramphenicol. In those cases where staphylococci are involved, especially in hospital practice, erythromycin or chloramphenicol may be used alone or in combination with penicillin. The meningococci respond well in most instances to penicillin. In H. influenzae infections, erythromycin, tetracycline, or chloramphenicol, alone or in various combinations, are effective. In infections due to Proteus or Pseudomonas it is at times necessary to employ polymyxin.

COMPLICATIONS OF ANTIMICROBIAL THERAPY

From the beginning of time there has existed a continuous conflict between man and micro-organisms, and today we find the bacterial world revolting violently against man's chemical attack upon its population. Many of these micro-organisms, if uncontrolled, are deadly enemies to man, others are harmless, whereas some are essential to man's survival. Fortunately, a number of the harmful bacteria have succumbed to the anti-

microbial agents, some have survived because of their effective protective mechanisms against these drugs, and others which were initially stunned have developed new defenses and are back on the firing line. Furthermore, others, which ordinarily are not injurious to man, have become agitated and are now pathogenic to man. Since these chemotherapeutic agents have no respect for members of the bacterial world, we find that in the process of successfully combating a disease state often bacteria which are helpful to man in his struggle for existence are destroyed.

For the most part, every known chemical substance can produce a toxic reaction in man if the exposure is adequate, thus making the use of these chemotherapeutic drugs by man a potential hazard. Each chemical agent has a nontoxic and a toxic dose, thereby making variable the factor of exposure. Furthermore, the severity of toxicity varies greatly with the method of administration, the degree and duration of the drugs used, and the condition of the patient. Unfortunately, the toxicity of chemical substances for use in man cannot be determined conclusively on animals, although toxicity studies involving animals alone can give reasonable assurance that the drug may be tried in man with some degree of safety. However, no criteria involving animals alone can prove toxicity or nontoxicity for man, thus making necessary toxicity determinations by human experimentation.

As a result of the above factors, we are confronted today with certain serious and unsolved problems relating to the use of these antimicrobial agents—namely, an increasing number of drug-resistant organisms; infections caused by micro-organisms usually regarded as nonpathogenic, which occur during antibiotic therapy, that prove insensitive to the drug being employed, and toxic reactions to these therapeutic agents.

DRUG-RESISTANT INFECTIONS

The widespread and indiscriminate use of the antimicrobial agents has resulted in an increased number of drug-resistant bacteria. This increased microbial resistance following exposure to an antibiotic holds not only for the antibiotic itself but also for the possibility of the development of cross resistance to other antibiotics. In considering this problem of drug-resistant infections, one must distinguish between the natural and the acquired resistance of micro-organisms. Natural resistance or susceptibility to these agents vary widely among bacterial species, as well as among different strains of a given species. Acquired resistance for the most part results from continued exposure to subinhibitory concentrations of these drugs. The development of resistance to streptomycin often occurs within a period of a few days, whereas very few organisms become resistant to penicillin.

At this time there is considerable controversy as to whether resistant strains appear because a few organisms that were originally present are genetically resistant to the antibiotic and grow out in large numbers as the remainder are inhibited by the antibiotic or whether, in the presence of an antibiotic, resistant mutants are allowed to survive and encouraged to proliferate. Regardless of the mechanism, it would appear that the organisms which are originally present in small numbers, or which are implanted from outside sources in small numbers, overgrow the predominant organisms because the latter are susceptible to the antibiotic, while those which replace them are not.

Hence, the problem of acquired drug resistance naturally raises the question as to whether it will ever be possible to find antimicrobial agents that will not induce resistance. Certainly, a therapeutic agent possessing specific killing properties presumably has the capacity to interfere with some part of a function which is vital to living organisms but not vital to the host. In both instances such a function or bypath must be more or less remote from the most fundamental features of life itself. This immediately implies the possibility for bypassing the function, and once this is realized, regardless of the manner of its occurrence, there will be resistance. In other words, a substance in-

capable of inducing resistance would seem to have little chance for possessing antimicrobial activity.

SUPERINFECTIONS

Antimicrobial therapy, in addition to eliminating the causative organisms of the infection, produces a profound alteration in the composition of the bacterial population that normally inhabits certain tissues and organs. The mechanism by which superinfection occurs during antimicrobial therapy is not clear. Normally, the body harbors many organisms which in small numbers are not pathogenic, are relatively avirulent, and cause no symptoms. When the normal ecology or microbiological balance is disturbed by antimicrobial therapy, such organisms may increase in numbers and invasiveness and give rise to infections. Occasionally, infections with micro-organisms usually regarded as nonpathogenic will occur during antibiotic therapy and prove to be insensitive to the drug being employed. Such superinfections result from the dislocation of the normal bacterial flora of the sinorespiratory, gastrointestinal, and genitourinary tracts. Several mechanisms to explain these superinfections have been postulated: (*a*) Administration of antibiotic results in virtual elimination of susceptible organisms, thus reducing the numbers competing for available food supply. The resistant organisms then vastly increase in numbers and overwhelm the host's resistance. (*b*) Normal flora supplies certain nutritional requirements of the host. Disturbance in the normal flora results in a nutritional disturbance which modifies the integrity of the mucous membranes, thereby opening a portal of invasion to organisms which normally are unable to penetrate the healthy mucosa. (*c*) Some antibiotics, like chlortetracycline, are suspected of directly stimulating growth and virulence of Candida albicans, with the ultimate production of candidiasis. In all probability, the mechanisms concerned involve alterations in both the host and the normal bacterial flora that follow the administration of an antibiotic. Such an opportune combination results in the appearance of a complicating infection during the course of a disease that appears to be responding favorably to chemotherapy. Hence, the importance of bacteriological studies to follow the changes in bacterial flora in various regions of the body in patients being treated for infectious diseases.

At this time it appears that the problem of antibiotic resistance of staphylococci is one of cross infection, or superinfection, by antibiotic-resistant strains acquired in hospitals in almost all cases. However, the increasing numbers of persons receiving hospital treatment who are discharged into the community and the large number of patients receiving antibiotics at home or on an ambulatory basis are certain to have their effects on the community.[6] This is true not only of resistant staphylococci, but also of resistant strains of Proteus, Pseudomonas, and Aerobacter. This is particularly true in cases of chronic infections of the respiratory tract and urinary tract, as these are usually mixed infections and are perpetuated by physiological and anatomical defects in the host. In such instances, these drugs cannot do more than provide temporary help and hence should be reserved to prepare the patient and carry him through the period necessary for the correction of an anatomic or physiologic defect. Thus, the best way to prevent the emergence of resistant strains is by the rapid termination of the infection and the optimum correction of anatomic defects. Furthermore, in view of the possibility of drug-resistant organisms developing, it would appear that the use of antimicrobial agents may unfavorably affect the postoperative infective rate in clean surgery. Not only is prophylaxis of doubtful efficacy but at the same time it may mask and delay the appearance of wound infections. It would seem, therefore, that important time and expense will be saved by the restriction of antibiotics to the early treatment of established infections in the few cases in which they do follow clean operations. It is probable that all wounds created by the surgeon's scalpel are contaminated at operation, and for this reason some have felt justified in administering antibiotic prophylaxis routinely

in all cases. However, as pointed out by Pulaski,[7] the causative organisms are most frequently the staphylococci, with the coliform bacilli, Proteus and Pseudomonas, and, occasionally, the hemolytic streptococci comprising the remainder. With the exception of the latter, these organisms are usually resistant to the antibiotics. This handicap, coupled with the fact that antibiotics are inefficient in the presence of dead tissues, makes it unlikely that routine chemoprophylaxis will further reduce the current low incidence of postoperative infections in clean surgical operations.

Prophylactic chemotherapy for elective surgery in contaminated cases is generally accepted on the premise that infection is avoided and optimal wound healing obtained if micro-organisms indigenous to the operative area are kept to the lowest possible number. Primary emphasis therefore is on preoperative reduction of the bacterial flora, the antibiotic being chosen on the basis of beforehand knowledge of the bacteriology and culture sensitivity of the body area involved. Antibiotics are continued to provide tissue levels of drug during operations. Postoperatively, the need for continued antibiotics is justified for 48 to 72 hours in the usual case. Certainly, no one questions the use of chemotherapeutic agents for the prevention of invasive infection in the infected case.

There is a definite danger in using antimicrobial agents in diseases that are not treatable, since superinfections, which may be a very small risk in untreated cases, may thus become a serious threat. In addition, prophylactic therapy will not prevent secondary infections in many cases; thus it is doubtful whether it will reduce the incidence of superinfections in certain diseases.[8]

Recently, Colebrooke,[9] the noted British bacteriologist, who, in 1936, presented the original clinical observations on the sulfonamide drugs, discussed the problem of cross infections in hospitals. He cited the fact that, in a general hospital, of 555 patients in the children's wards during a 12-month period more than 13% acquired manifest or latent infection by hemolytic streptococci. Another study, based on clinical findings in 14 English hospitals, showed that of 10,000 children in a 10-month period 7% developed signs of cross infections. In 41 of these, death occurred which was judged to be in part, or wholly, due to acquired infections. In all, infections of the upper respiratory tract took first place. It was felt that many infections, both in and out of hospitals, owe their origin to organisms expelled from the throat and nose of patients suffering from some infective condition of the upper respiratory tract.

TOXIC REACTIONS

In evaluating the toxicity of drugs in man, one not only considers the immediate side-effects but also the delayed reactions, which may require years of observation. Certain of these side-effects are toxic, some are allergic, and others are related to the biologic activities inherent in the chemotherapeutic substances themselves.

Penicillin.—The chief untoward reactions to penicillin therapy fall into three principal groups: (1) local contact (skin, mucous membranes, and injection site); (2) dermatological allergy (urticarial, erythematous, and eczematoid); (3) systemic (serum sickness, anaphylactoid, cardiovascular, and renal). In addition, there have occurred certain specific phenomena associated with some particular disease being treated with penicillin, such as the Herxheimer reaction in syphilis and the development of a Loeffler's syndrome following aerosol penicillin in the treatment of some types of pulmonary disease. Furthermore, evidence is pointing toward penicillin's giving rise to a variety of disorders, including agranulocytosis, periarteritis nodosa, the production of lupus erythematosus cells in the bone marrow, and others.

At the time that penicillin was first made available for general civilian use, it was not fully understood how many of the toxic reactions described were due to impurities in the penicillin preparations and how many to the drug itself. Probably the total incidence

of penicillin reactions has been decreased because of the increased purity of the drug and the introduction of procaine penicillin. However, the total number of reactions has increased steadily, and today penicillin heads the list of medicinal agents in frequency, diversity, and severity of the sensitivities it produces. No doubt this is a result of the fact that the drug is used promiscuously and repeated administration of it to ever-increasing numbers of people has resulted in their being conditioned to show various manifestations of hypersensitivity when exposed to subsequent penicillin therapy. Rarely does a patient experience a reaction after the first dose of penicillin, whereas the reactions become more frequent and more severe in persons who have repeated doses. Some of the reactions occurring after the first dose are believed to be related to cross reactions with other fungi, particularly trichophytosis (athlete's foot). The more serious reactions, such as anaphylactic shock, occur most often in patients with allergic histories, especially asthma. Although any penicillin preparation and any mode of administration can cause a reaction, it appears that oral penicillin is the least likely, parenteral preparations are next in frequency, and topical penicillin the most likely to cause reactions. Reports of acute anaphylactoid reactions due to penicillin are being published with increasing frequency, with most of the severe cases following the administration of procaine penicillin. This may be due to a greater amount of sensitizing substance that is present longer or to the possible synergistic effect when two substances are injected simultaneously.

In spite of the foregoing, penicillin remains the least toxic of the currently available antimicrobial agents. Its well-established therapeutic value and relatively lower cost combine to establish it as the most popular drug. Hence, every effort should be made to minimize the reactions following its administration. A history of previous penicillin toxicity should, in most cases, contraindicate the use of penicillin and manifest the desirability of administering another antibiotic, if possible. However, many patients can tolerate penicillin, even after a previous allergic reaction, and in such conditions as subacute bacterial endocarditis, in which penicillin is strongly indicated, one may proceed with caution. When reactions do occur and are not too severe, treatment can usually be continued with the aid of antiallergic remedies. Obviously, the more serious reactions demand discontinuance of the drug. Such reactions as anaphylactoid shock and exfoliative dermatitis demand prompt attention and treatment with supportive measures, epinephrine, antihistaminics, and corticotropin (ACTH). The advisability of using a penicillin product in which an antihistaminic agent is included can be questioned, in that one is adding another potentially toxic agent. Where possible, penicillin should be used orally in preference to the parenteral route. Intramuscular injections must be given with caution, as it has been implied that some of the severe, or fatal, reactions are the result of the accidental intravenous injection of procaine penicillin. Topical application in the form of troches, toothpaste, aerosol, ointments, and dusting powders is of doubtful value in most instances and should be discouraged.

Some investigators rely on skin testing as a guide in determining possible penicillin sensitivity, but as yet there seems no complete agreement as to the value and significance of skin-test results, with the possible exception of the immediate whealing reaction on cutaneous or intracutaneous testing as regards the development of an anaphylactoid reaction.

Efforts to desensitize patients who have experienced penicillin reactions have been considered successful in the hands of some experienced workers. This procedure may be tried, especially when the patient's occupation, e. g., nursing, necessitates exposure to the drug or in conditions where penicillin is urgently needed. If the sensitivity reaction has been severe, an initial dose of 2 units of aqueous penicillin G is given intramuscularly, whereas other cases are given 50 units every 3 hours the first 24 hours, 100 units every

3 hours the second 48 hours, with the dose being doubled each 24 hours until the patient can tolerate 200,000 units.

Streptomycin and Dihydrostreptomycin.—In general, the severity of toxicity from both streptomycin and dihydrostreptomycin is dependent upon the duration of therapy, total dose employed, and degree of renal impairment, the principal toxic effect being damage to the eighth nerve and vestibular apparatus. While this is particularly true of streptomycin, there seems to be a lesser tendency of dihydrostreptomycin to affect the vestibular apparatus. However, damage to the auditory branch of the eighth nerve with hearing loss may occur. Since patients are able to compensate for damage to the vestibular branch but are not able to compensate for auditory damage, it is obvious that dihydrostreptomycin is less desirable, especially for long-term therapy, as is necessary in tuberculosis, than is streptomycin. Occasionally, dihydrostreptomycin is useful in patients who are allergic to streptomycin, as sometimes allergies do not develop in patients receiving this drug in whom, were they receiving streptomycin, allergies would develop. The recent practice of employing mixtures of streptomycin and dihydrostreptomycin has markedly reduced this toxic effect. Either of these compounds may give rise to a variety of less severe reactions, including the sensitivity reactions encountered with penicillin. Certainly, special precautions are indicated in patients with impaired renal function who receive either streptomycin or dihydrostreptomycin.

Broad-Spectrum Antibiotics.—The tetracyclines (chlortetracycline, oxytetracycline, and tetracycline) frequently give rise to gastrointestinal and genitourinary disorders (nausea, vomiting, diarrhea, stomatitis, vaginitis, and proctitis). While these are not usually serious, they do cause considerable inconvenience and at times become severe. In my experience to date, chlortetracycline appears to be the most offensive in this manner. It is felt that these untoward reactions are due, at least in part, to alteration in bacterial flora leading to a vitamin B deficiency. There is evidence to support the view that chlortetracycline stimulates the growth of some types of fungi, notably C. albicans, and that these two factors combine to produce a moniliasis. When these drugs are used for periods exceeding seven days, the patient should receive buttermilk, vitamin B complex, and cyanocobalamin (vitamin B_{12}) orally; if toxicity develops, the drug should be discontinued if possible, and injections of crude liver, or cyanocobalamin given daily. More recently, nystatin has been introduced as an agent for the prevention and management of gastrointestinal moniliasis. Nystatin is available as 500,000 unit tablets to be given three times a day and is stated to be compatible with all the present orally administered antibiotics.

Chloramphenicol.—Chloramphenicol gives rise to the same toxic reactions as the tetracycline group, although one difference does exist, in that chloramphenicol exerts at times a toxic effect upon the hemopoietic system.

Erythromycin.—Erythromycin appears to be of relatively low toxicity, and the only undesirable effect noted in many patients treated with this drug has been an occasional gastrointestinal upset with high dosage. It does not appear to have as adverse an effect on the ecology of the gastrointestinal flora as do the tetracyclines; some of the symptoms of the antibiogenic syndrome are thus avoided.

Polymyxin.—Although polymyxin B sulfate is an agent of considerable toxicity (renal and central nervous system), its unique effectiveness in infections due to P. aeruginosa has justified its introduction into clinical practice. This antibiotic should be employed parenterally only in hospitalized patients, since careful observation for renal damage is essential to its safe use.

Bacitracin.—Since the parenteral administration of bacitracin is often followed by kidney damage and only a small amount is absorbed when given by mouth, this drug finds its chief usefulness as a topical or oral medicament.

Neomycin.—When administered systemically, neomycin may cause slight to severe deafness as well as transient renal irritation. Since this drug is not absorbed into the circulating blood stream from the gastrointestinal tract or skin, it has found its chief usefulness in preoperative preparation for intestinal surgery and as a topical medicament, although in selected cases, especially in Proteus and Pseudomonas infections, it may be administered intramuscularly for short periods of time.

Isoniazid.—The administration of isoniazid may be followed by a variety of untoward reactions, the severity of which depends on the dosage, length of administration, renal function, and personality stability. Such symptoms as increased reflexes, headache, muscular twitchings, peripheral neuropathy, euphoria, excitability, constipation, vertigo, dryness of mouth, and visual difficulties are the principal toxic side-effects encountered. Cessation, or decrease, in therapy is dependent upon the type and severity of the reaction. Recently, the use of pyridoxine hydrochloride has been shown to be effective in relieving pain in cases with peripheral neuropathy.

Nitrofurantoin. — Nitrofurantoin (Furadantin) has been well tolerated when given orally in daily dosage of 5 to 8 mg. per kilogram of body weight, in four divided doses, with meals and with a bedtime snack. Larger doses result in nausea and vomiting. The drug is tolerated without reaction even in patients known to be sensitive to the related compound nitrofurazone (Furacin).

Nystatin.—Nystatin (Mycostatin), derived from cultures of Streptomyces noursei, has been shown to inhibit or kill many species of fungi and yeasts. After oral administration this antibiotic is poorly absorbed. Thus far, it appears to be virtually nontoxic following oral or local administration.

Sulfonamides.—Despite the advent of penicillin and the other antibiotics, the sulfonamides are still being employed, especially in the treatment of urinary tract infections. In discussing the untoward reactions associated with their use, it is well to point out several factors which tend to influence their incidence and severity. The length of time that the drugs are administered and the total dose employed are probably the most important factors. Children seem to tolerate these drugs better than the aged; those with good nutrition and normal renal function, better than the poorly nourished and those having kidney damage.

A variety of untoward reactions may follow the administration of the sulfonamides, some of which are mild, while others may be severe, or even fatal. Whereas most of these complications are seen during the administration of the drug, there are some, such as periarteritis nodosa, which become manifest at a later date. The commonest toxic reactions are nausea, vomiting, fever, dermatitis, anemia, neutropenia, agranulocytosis, psychoses, and those referable to the urinary tract. This latter group may be manifested by hematuria, oliguria, or anuria and are most frequently encountered following the sulfapyrimidines. In this connection, the belief is widely held that administration of sufficient fluid to insure a high urinary output is enough to prevent crystalluria, which is responsible for most cases of urinary toxicity. Nevertheless, high volumes of urine will not forestall precipitation of sulfapyrimidines; however, chemical and clinical studies of these compounds have demonstrated that the total amount of sulfonamide which can be held in solution in urine is substantially increased when two or more of these substances are administered simultaneously and that this is accomplished without sacrificing therapeutic activity. Thus, it is possible to lessen the hazards of urinary tract complications due to sulfonamide crystals or calculi. Hence, the rationale for the combination of sulfadiazine, sulfamerazine, and sulfamethazine. However, it is still important when using the sulfapyrimidines to maintain a urinary output of at least 1200 cc. daily.

COMMENT

In view of the above facts concerning the potential dangers associated with antimicro-

bial therapy, all physicians should lend a hand in a crusade for the rational use of these drugs. However, in order to lead such a crusade, one should first discover what errors of judgment and practice have brought about these conditions. First, there is a belief that antibiotics are nontoxic and will do no harm, even if they do no good. It is easy to see how this view arose. Penicillin had a much greater margin between effective and toxic dose than any other previous antimicrobial agent, and untoward reactions were virtually unknown in the early days, when it was administered in doses on the order of 15,000 units every four hours. Only when very much larger doses came to be used, at first for special cases but later almost as a matter of routine, and when sensitized patients came for second courses of treatment, did it become clear that the drug was not altogether harmless. Later antibiotics are, in general, more toxic than penicillin and so allow less latitude in dosage. Second, many doctors are guided by the popular, but fallacious, generalization that if a little does good a lot will do better. Many causes doubtless combined to foster the use of big doses—they were required for bacterial endocarditis, they would stop the emergence of resistant strains, they would make for less frequent administration, and they would penetrate to the deepest parts of hidden lesions. Such considerations neglect two essential points, namely, that many antibiotics have a relatively narrow zone of optimal concentration and that the doses recommended by manufacturers are the outcome of extensive pharmacological and clinical studies. As has been rightly pointed out, clinical investigators should aim at determining the smallest amount that is effective therapeutically. Third, since antibiotics are so dramatically effective against grave illnesses, they will be at least equally useful for the treatment of minor disabilities, such as the common cold and other diseases of noninfectious origin. On the whole, these drugs are disappointing in the treatment of such states, and the most probable outcome of their use is sensitization of the patient and the dissemination of drug-resistant organisms.

SUMMARY AND CONCLUSIONS

Certainly, the science of otolaryngology has changed tremendously since Benjamin Franklin's day. We have witnessed significant advances in the management of infections of the upper respiratory tract, although there remain many unsolved problems. The antimicrobial agents have become valuable adjuncts in the practice of surgery, but it is to be remembered that, regardless of their proved prophylactic and therapeutic effectiveness, they are not to be used to the exclusion or neglect of other proved forms of therapy, such as good surgical technique. Furthermore, in view of the potential hazards associated with these drugs, their use should be reserved primarily for established infections in which the causative agent is known to be sensitive to their action. It therefore behooves the surgeon to reexamine the circumstances in which these agents are employed before, during, or after operation.

REFERENCES

1. Fisher, S. G.: The True Benjamin Franklin, Philadelphia, J. P. Lippincott Company, 1899.

2. Franklin, B.: An Account of the New Invented Pennsylvania Fire-Places, Philadelphia, The Author, 1744.

3. Solis-Cohen, M.: Recognition Through the Centuries of the Relationship Between Local and General Diseases, Bull. Hist. Med. **26**:526-537 (Nov.-Dec.) 1952.

4. Culpeper, N.; Cole, A., and Rowland, W.: The Compleat Practice of Physick in Eighteen Several Books, Being Chiefly a Translation of the Works of that Learned and Renowned Doctor, Lazarus Riverius, London, Peter Cole, 1655.

5. Welch, H.: Antibiotics in Respiratory Infections, Antibiotic Med. **1**:59-63 (Feb.) 1955.

6. Finland, M.: Emergence of Antibiotic-Resistant Bacteria, New England J. Med. **253**:909-922 (Nov. 24); 969-979 (Dec. 1); 1019-1028 (Dec. 8) 1955.

7. Pulaski, E. J.: Are Antibiotics of Value Before and/or After Operation? Antibiotic Med. **1**:317-318 (June) 1955.

8. Weinstein, L.: The Chemoprophylaxis of Infection, Ann. Int. Med. **43**:287-298 (Aug.) 1955.

9. Colebrooke, L.: Infection Acquired in Hospitals, Lancet **2**:885-890 (Oct. 29) 1955.

Management of Recurring Parotid Tumors

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In 1951 Kirklin and co-workers [1] reported a study of 986 cases of parotid tumor seen at the Mayo Clinic from 1907 to 1944. They found that a little more than 300, or roughly one-third, of the patients had received previous surgical treatment for their parotid tumors by the time they entered the clinic. A previous operation had been performed on 33% of the patients with mixed tumor, 28% of the patients with Warthin's tumor, 28% of the patients with simple cyst, 52% of the patients with mucoepidermoid tumor, 53% of the patients with adenocarcinoma, 44% of the patients with cylindroma, 73% of the patients with undifferentiated carcinoma, 50% of the patients with undifferentiated sarcoma, and 54% of the patients with squamous-cell carcinoma. In other words, in roughly one-third of the patients with benign parotid tumor and in approximately one-half to two-thirds of the patients with malignant parotid tumor previous surgical treatment had been attempted. These are not unusual figures. Frazell,[2] at the Memorial Hospital in New York, reported similar findings.

How is it that there should be such local recurrence rates for parotid tumors? There are many reasons. These can be divided into three groups. The first has to do with the nature of the tumor itself; the second, with the profession, and the third, with the patient.

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REASONS FOR RECURRENCE

The Nature of the Tumor.—It is obvious that the role of local recurrence is very high in patients with undifferentiated carcinoma and "malignant tumor." None of these lesions have a "capsule" (and, for that matter, neither does a mixed tumor have a true capsule); they infiltrate the parotid quickly and get out of the gland into perineural lymphatics and surrounding tissues, and so surgical treatment, if it is to be curative, must be given very early. This, then, involves the next group.

The Profession.—Fortunately, the idea of watchful waiting is fast disappearing. The knowledge now that long-standing mixed tumors can undergo malignant change certainly militates against leaving a parotid tumor alone. The ease with which a mixed tumor can be seeded in the parotid gland and surrounding tissues makes local excision a dangerous practice, and it should be a thing of the past. Office surgery and incisional biopsy should be condemned. The operation should be done in the operating room, where all modern facilities are available, including facilities for making fresh frozen sections. The patient should be properly prepared both mentally and physically. The surgeon should be capable of doing an adequate and definitive operation. Wide exposure of the gland, early exposure of the nerve as it comes out of the stylomastoid foramen, and the practice of doing a subtotal parotidectomy (superficial lobectomy) for all benign tumors and even for some malignant ones are becoming widely accepted and should go a long way toward reducing the high rate of local recurrence. Timid and hesitant surgical treatment, brought about by fear of injury to the facial nerve, has no place in the modern operative suite. Total parotidectomy with sacrifice of the facial nerve must be done for many of the

malignant tumors if any reduction in the rate of local recurrence is to take place. This, of course, means a deformity, and that brings up the third group.

The Patient.—Every patient should have a preoperative discussion with the surgeon regarding the possibilities of injury to the facial nerve. He should be told that any injury of this nerve will be purposeful and will be based on the findings at operation; that, in practically all cases, injury of the nerve will mean that the tumor was found to be invasive and malignant and that, therefore, sacrifice of the nerve was necessary in the performance of what might prove to be a lifesaving procedure. The proper approach to this distressing subject will vary from patient to patient. Rarely will a patient refuse to have done what seems necessary in this regard, but it is true that this one factor (the fear of facial deformity) makes for difficult decisions at the operating table. For instance, after what appears to be a very adequate removal of a supposedly benign tumor by subtotal parotidectomy (or after biopsy), the pathologist comes in to announce that the tumor is malignant. The surgeon then has the most difficult problem of deciding whether to proceed immediately with total parotidectomy and sacrifice of the nerve and whether to do a dissection of the neck. Whether we like it or not, then, we are always going to have to face the problem of the recurrent parotid tumor.

RECOGNITION OF RECURRENCE

The diagnosis of recurrent parotid tumor usually may be made easily. Tissue or microscopic slides and a record of the operative procedure are available from a previous operation. The clinical findings are usually obvious, and the problem is not one of diagnosis but rather, in many cases, one of answering the question, "Will a further operation do any good?" In this respect we have purposely refrained from using the term "inoperable." The criteria of inoperability may vary from medical center to medical center, from surgeon to surgeon in any one center, and from time to time in any one surgeon. It depends upon the experience, training, and philosophy of the individual surgeon.

FACTORS TO BE CONSIDERED IN TREATMENT

The question of whether or not to operate on a given patient with a locally recurring parotid tumor can be solved by careful consideration of three factors: the microscopic nature of the tumor, the local and distant extent of the tumor, and the general condition of the patient.

We wish to say that as a rule we would refuse to reoperate on a patient with a recurring undifferentiated carcinoma or a highly malignant adenocarcinoma or squamous-cell epithelioma if there had been an honest and competent attempt to remove the tumor previously, especially if there were bulky recurrent lesions, deep fixation, and widespread local infiltration. In such a situation, irradiation would be the treatment of choice. The exact type would be decided upon after consulting with our radiologists. As a rule, we have found that external irradiation alone does very little, if anything, to most parotid tumors. Interstitial irradiation with gold wires or radon seeds and external irradiation, however, are very much worth while in the cases in which further surgical treatment is not recommended or in which operation has revealed that not all of the tumor can be removed. However, if the recurrent lesion from one of these highly malignant tumors seems small and is not attached to deeper structures, one would be justified in doing a total parotidectomy with sacrifice of the facial nerve and radical dissection of the neck whether or not there are clinically evident metastatic cervical lymph nodes.

In the case of low-grade mucoepidermoid tumor, cylindroma, and low-grade adenocarcinoma, some exceptions are made regarding sacrifice of the facial nerve and dissection of the neck. There are no definite, hard, fixed rules to follow. Frazell [2] said, when talking about this subject, "Available data concerning the incidence of metastatic cervical lymph nodes in salivary-gland cancer suggest that neck dissection in combination with parotidectomy is generally advisable for recurrent malignant tumors, whether or not clinically

metastatic cervical lymph nodes can be demonstrated. Exception may be made in the case of acinic-cell and low-grade mucoepidermoid tumors."

Kirklin and co-workers [1] found lymph-node metastasis in 23.6% of patients with cylindroma, 31.5% of patients with adenocarcinoma, 53.9% of patients with squamous-cell epithelioma, 44.8% of patients with undifferentiated carcinoma, and 10.6% of patients with mucoepidermoid tumor. Examination of the records of patients with parotid cylindroma revealed that 29.4% had pulmonary metastasis; 13% of the patients with adenocarcinoma had pulmonary metastasis, but none of the patients with squamous-cell epithelioma or undifferentiated carcinoma had such metastasis.

In some cases of recurring cylindroma, low-grade mucoepidermoid tumor, or adenocarcinoma in which there is fixation to surrounding structures, such as the mandible, ear, skin, or mastoid, more radical surgical attempts at removal are sometimes justified. This is especially so if there is a relatively long history of the lesion, considerable constant local pain, or foul odor and discharge from radionecrotic tissue or broken-down tumor. Such conditions are occasionally encountered, especially in patients suffering from cylindroma. It would be foolish to consider any radical operation in the presence of pulmonary metastasis in the case of any other parotid tumor but the cylindroma. A radical operation is occasionally justified in this situation to relieve the patient of an intolerable local condition. Pulmonary metastatic lesions from cylindroma are notoriously slow to cause symptoms.

Patients suffering from recurring mixed tumor are seldom sent away without another attempt at removal. We are gradually coming around to the idea that one should rarely, if ever, deliberately sacrifice the facial nerve when trying to remove a recurring mixed tumor of the parotid. Of course, one must be very sure that he is dealing with only a mixed tumor and not in reality with a cylindroma. In our experience, the average pathologist frequently fails to recognize the difference between the two, and the surgeon and patient are lulled into a false sense of security.

In some instances of recurring mixed tumor there has been such massive seeding of the gland that the nerve is encased in tumor and there is no choice but to sacrifice all or part of the nerve deliberately. In general, however, we believe that it might be better to run the risk of another recurrence of the mixed tumor and save part or all of the facial nerve, especially in young patients, if, in so doing, a reasonably satisfactory clean surgical removal can be accomplished. In the past, a combination of electrodissection and surgical diathermy with the Bovie unit was used in many cases of recurring parotid cylindroma and mixed tumor. This was often combined with interstitial irradiation. This method proved to be satisfactory except for the later hemorrhages from the open wounds and the delayed healing and sequestration that often followed. Because of these objections and because of the ease and safety with which more radical dissection by the cold knife can be accomplished now, electrosurgical methods are used much less frequently than in former years.

In patients in whom the facial nerve is deliberately sacrificed, we have also been doing either immediate fascia lata grafts or nerve grafts in selected cases. The late insertion of fascia lata grafts is a much commoner procedure, and for years it was the usual practice to wait a year or more before going ahead with corrective procedures.

Skin grafting in patients with recurring parotid tumors in years gone by has been used more as a late or delayed procedure, and more often than not it was of the multiple-stage type of pedicle grafting to cover defects that followed the use of surgical diathermy combined with radium or x-ray therapy, or combined with both radium and x-ray therapy.

Recently the skin grafts have been more of the split-thickness free-graft type, placed on the wound immediately after extensive surgical resection of skin and neighboring structures in the parotid region. These radical and extensive operations, which may

involve resection of the mastoid, ear, ascending ramus of the mandible, and involved skin and radical dissection of the neck, are performed on patients whose condition is desperate but not entirely hopeless. Admittedly, the salvage rate after such extensive surgical procedures is small, and as more experience is gained and evidence accumulates, it may be that they will be abandoned as not being worth while.

CONCLUSION

It is to be hoped that there will be fewer recurring parotid tumors in the future, because of the acceptance of the belief that every parotid tumor should be removed early and the general practice of wide surgical exposure of the gland, early exposure of the facial nerve as it comes out of the stylomastoid foramen, and the performance of subtotal or total parotidectomy rather than extracapsular enucleation. In spite of all precautions, however, there will continue to be some recurring parotid tumors, because of the nature of the tumors that occur in this region and the human desire to avoid facial deformity.

REFERENCES

1. Kirklin, J. W.; McDonald, J. R.; Harrington, S. W., and New, G. B.: Parotid Tumors: Histopathology, Clinical Behavior and End Results, Surg. Gynec. & Obst. **92**:721-733 (June) 1951.

2. Frazell, E. L.: Clinical Aspects of Tumors of the Major Salivary Glands, Cancer **7**:637-659 (July) 1954.

Bell's Palsy

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The most fascinating and interesting nerve of all the cranial nerves with which the otolaryngologist is in daily contact is the facial nerve. It controls the actions of the largest group of muscles upon which people are almost wholly dependent for their daily social contact. The loss of function of the nerve and the facial muscles produces a profound depressing effect upon the psyche. It is not until the development of Bell's palsy that the necessity of a normally functioning facial nerve and musculature makes a strong impact upon the patient, other lay people, and even the physician.

The current-day literature on the therapy of this condition is rather sparse when one considers that the condition is not uncommon, that recovery is slow, that it seriously affects the economic and social status of a person, that residuals all too often are seen which change the physiognomy of a person as well as his outlook on life.

This condition properly belongs in the realm of the otolaryngologist. The otolaryngologist is equipped with the knowledge of the medical and surgical therapy of diseases and injuries of the facial nerve and should be the first to institute therapy. In most cases he can effect a return of function of the nerve by medical means, and, when these fail, he can adopt the proper surgical measures before there is any permanent damage in the way of atrophy of the facial mimetic musculature.

There is very little dispute as to the pathologic process responsible for Bell's palsy.

1. Kettel states that "everything indicates that Bell's palsy is due to the fact that ischemia exists near the stylomastoid foramen, an arteriospasm according to Hilger. The ischemia is the primary cause of the palsy, and, resulting from it, various structural alterations take place in the facial nerve between the lateral semicircular canal and the stylomastoid foramen, at which point the nerve leaves the fallopian canal; in some cases these changes occur in the surrounding bone also. The nerve becomes unduly constricted at the stylomastoid foramen, and tiny hemorrhagic streaks can be observed in the nerve running longitudinally. The nerve becomes edematous."

2. R. Wyburn-Mason believes that in a large proportion of cases a lower-motor-neuron facial weakness constituting Bell's palsy is the result of a neuritis or irritation of the great auricular nerve, which extends into the facial nerve as it lies in the region of the parotid gland.

3. Agnar Hall, Norrköping, Sweden. Three cases of Bell's palsy in which a resection of the mastoid cells and a decompression of the facial nerve were done are reported. In all cases an exudate was found in the cells in the tip of the mastoid process, and, in one, some larger cells contained a yellow serous fluid. The bone near the stylomastoid foramen was soft, and the facial nerve, highly edematous.

4. Robinson and Moss treated two patients with cortisone and have achieved good results. However, it is felt that the reactions and complications resulting from cortisone therapy far outweigh the results obtained.

In the military service in the past, it was customary in some otolaryngological and neurological sections to hospitalize patients with this disease until function of the nerve returned. This oftentimes necessitated a hospital stay of two to three months.

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A course of therapy, previously described by Loomis, was instituted for all patients presenting themselves to this clinic with Bell's palsy. Loomis described such marvelous results that the therapeutic regimen, with slight modifications, was adopted by me for a series of five cases also.

THERAPEUTIC REGIMEN

1. Hospitalization for complete rest.
2. Multivitamin capsules, 2 every morning.
3. Thiamine HCl, 10 mg. four times a day.
4. Histamine diphosphate, 2.75 mg. in 150 cc. of saline given intravenously daily. The solution is allowed to drip at a slow rate, starting with 30 to 40 drops per minute, depending upon the rapidity with which the patient can accept the drug. The solution is allowed to drip rapidly enough to allow the patient to flush slightly. After one and one-half hours the needle is removed from the vein whether or not all the solution has entered. The rapidity of flow of the solution must be controlled daily, inasmuch as it will be found that the patient will be able to tolerate a greater rapidity of flow from day to day. If at any time the patient complains of headache, the flow of the histamine solution is reduced.

Before, during, and after the histamine solution is introduced into a vein, the patient's blood pressure is watched for any untoward drop.

5. Physical therapy. On the first visit, at which time the patient is hospitalized, the patient is subjected to galvanic and faradic stimulation. After electrostimulation for the determination of muscle and facial nerve function, the patient is given an appointment for daily galvanic stimulation to the facial mimetic musculature plus a daily treatment of infrared ray for from 15 to 20 minutes.

6. Self-willed promotion of function return. The patient is required to spend 20 minutes four times daily by himself before a mirror to focus his attention upon one group of the mimetic musculature (e. g., cheek muscles) to promote function of these muscles.

At no time during the above course of therapy was it found necessary to resort to facial splinting with adhesive tape, Scotch tape, or a tarsorrhaphy.

Five cases with frank, complete unilateral Bell's palsy are presented. In all of the cases there was a return of function of some of the muscles within 24 hours after the first treatment. Once the function began to return in one muscle or one group of muscles, it was noted that the one muscle or the one group of muscles became more active and stronger daily and that concomitantly the remainder of the facial mimetic musculature began to respond. On an average, all function returned within 14 days, and in two instances the recovery was sooner. It was also noted that recovery was without the stigma of a slight drooping of the lower eyelid while the facial muscles were still or in motion. Of great importance was the psychical reaction of the patient. In all cases the mental depression left completely when they observed a beginning of return of facial muscle function. I do believe that the release of this heavy psychogenic anxiety overlay plays an extremely important role in the therapy.

REPORT OF CASES

CASE 1.—A 22-year-old woman developed a complete paralysis of facial muscles of the right side of the face two months prior to seeking aid and therapy. Physical examination and laboratory studies revealed no other abnormalities or disease. She was immediately hospitalized, and the intravenous histamine therapeutic regimen was started. On the fourth day there was beginning return of function of the cheek muscles. By the eighth day there was return of function of all facial muscles except the frontalis of the right side. Galvanic and faradic stimulation revealed an almost complete return of the function of the facial mimetic musculature excluding the right frontalis muscle. The patient was discharged from the hospital on the ninth day to continue therapy on an outpatient status. Follow-up observation revealed a complete return of facial muscle function.

CASE 2.—A 31-year-old man developed a complete facial paralysis of the left side on Nov. 30, 1954. Physical examination and laboratory studies revealed no further pathology. The patient was hospitalized on Dec. 1, 1954, and the intravenous

histamine therapeutic regimen was initiated. One day later, Dec. 2, 1954, there was voluntary motion of the cheek muscles of the left side. Five days later there was weak voluntary motion of the complete facial mimetic musculature. On Dec. 12, 1954, there was complete return of muscle function, and the patient was not required to return for further outpatient therapy.

CASE 3.—A 23-year-old man had a gradual onset of right-sided facial paralysis for two days prior to reporting to the hospital for therapy. On the day of admission to the hospital the patient had complete right-side Bell's palsy. He was immediately started on the intravenous histamine therapy. On Jan. 26, 1955, one week after admission, the muscle function of the right side of the face had begun its response. Six days later, on Feb. 1, 1955, there was complete return of function of all facial musculature of the involved side.

CASE 4.—A 25-year-old man developed complete Bell's palsy, right side, one day prior to hospitalization on Oct. 13, 1954. Intravenous histamine therapy was initiated immediately. Nine days later there was beginning return of function. On the 15th day after admission the patient had functional return of the facial musculature of the right side of the face.

CASE 5.—A 57-year-old man developed complete Bell's palsy, right side, on June 6, 1954. He was hospitalized on June 8, 1954, and was started on the intravenous histamine therapeutic regimen. Three days later, on June 11, 1954, there was motion of the muscles beneath the right eye. On June 14, 1954, there was beginning motion of all the right facial muscles. The patient was discharged from the hospital to continue his vitamin and massage therapy on an outpatient status.

REFERENCES

1. Kettel, K.: So-Called Rheumatic Facial Paralysis from Surgical Point of View, Ugesk. læger **115**:353-361 (March 5) 1953.

2. Robinson, W. P., and Moss, B. F.: Treatment of Bell's Palsy with Cortisone, J. A. M. A. **154**:142-143 (Jan. 9) 1954.

3. Wyburn-Mason, R.: The Nature of Bell's Palsy, Brit. M. J. **2**:679-681 (Sept. 18) 1954.

4. Loomis, G. L.: Histamine Treatment of Bell's Palsy: Report of 5 Cases, Arch. Otolaryng. **52**:948-950 (Dec.) 1950.

Choanal Atresia

An Embryological, Clinical, and Therapeutical Study

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and
R. RAMOS CALVO, M.D., Granada, Spain

Since 1829, when Otto [1] published the first paper on choanal atresia as an autopsy discovery, many articles on the subject have been presented in the medical literature. Such papers have appeared even more frequently in recent times, not because the condition is rare, as always has been supposed, but because it is now better diagnosed and we think of it more frequently. Thus, Ronaldson,[2] in 1881, described a case of bilateral membranous choanal atresia that he recognized clinically. Surgical intervention was postponed, and the child died of asphyxia. He suggested in his commentary that if this possibility was considered by the obstetrician and pediatrician many of the cases diagnosed as neonatal asphyxia would be attributed to choanal atresia.

Nevertheless, Kazanjian [3] tried to demonstrate the rarity of choanal atresia, and on review of the records of the Massachusetts Eye and Ear Infirmary from 1922 to 1938 he found only 10 cases of the condition among a total of 62,228 patients.

Cinelli [4] found 220 cases reported in the world medical literature in the 90 years before 1940.

Beinfield [5] mentioned 54 new cases reported in the American literature from 1940 to 1949 and considered choanal atresia to be not so unusual as was formerly thought.

At present, the number of cases published exceeds 300, but we have to consider that the frequency of the condition is greater if we include cases which have been overlooked because, being bilateral, they were incompatible with life or because in unilateral cases the condition remained unknown to the patient.

We present a case of unilateral choanal atresia treated surgically by the transpalatine approach. This will give us the opportunity, after presentation of our technique, to add some considerations about the development of the choanae that we think of interest.

REPORT OF A CASE

A 12-year-old girl, born in Granada, was seen on Nov. 4, 1953. There was no family record of congenital deformities. Her parents remarked that from birth she did not breathe through the right side of the nose. Thick and sometimes yellow-green discharge flowed from the right naris. For several years she had had headaches and frequent colds as well as bad taste and odor in the mouth. She had no other complaints.

On anterior rhinoscopy we noticed a right nasal cavity full of mucus, which when cleaned revealed a deviated septum on the right side. Exploration with a stylet disclosed the existence of a hard bony plate situated on the posterior border, interfering with passage toward the nasopharynx. Posterior rhinoscopy showed the existence of a tightening or imperforation of the right choana that presented an infundibular aspect and deviation to the right side of the nasal wall.

X-ray plates in nasomentopalatine position showed reduction of the translucence of the right nasal fossa and deviation of the nasal wall (Fig. 1).

On radiography with a contrast medium (iodized oil [Lipiodol]) there could be seen, in the lateral position (Fig. 2) as well as in the submental-vertical position of Hirtz (Fig. 3), an atresia of the infundibular type shaped at the base like a little sac and slightly enlarged at the border.

The size and development of the paranasal sinuses were practically normal (Fig. 1) and corresponded to the patient's age, as did her mastoid pneumatization (Fig. 4).

The completed audiogram showed no remarkable loss in audition, which was considered as normal,

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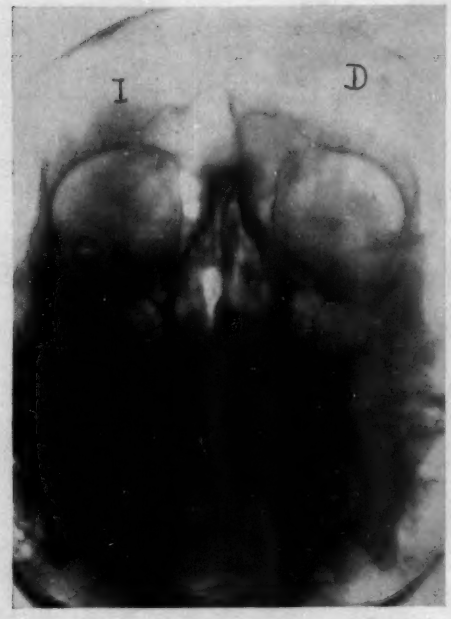

Figure 1

Figure 3

Figure 2

Fig. 4.—Right side (above); left side (below).

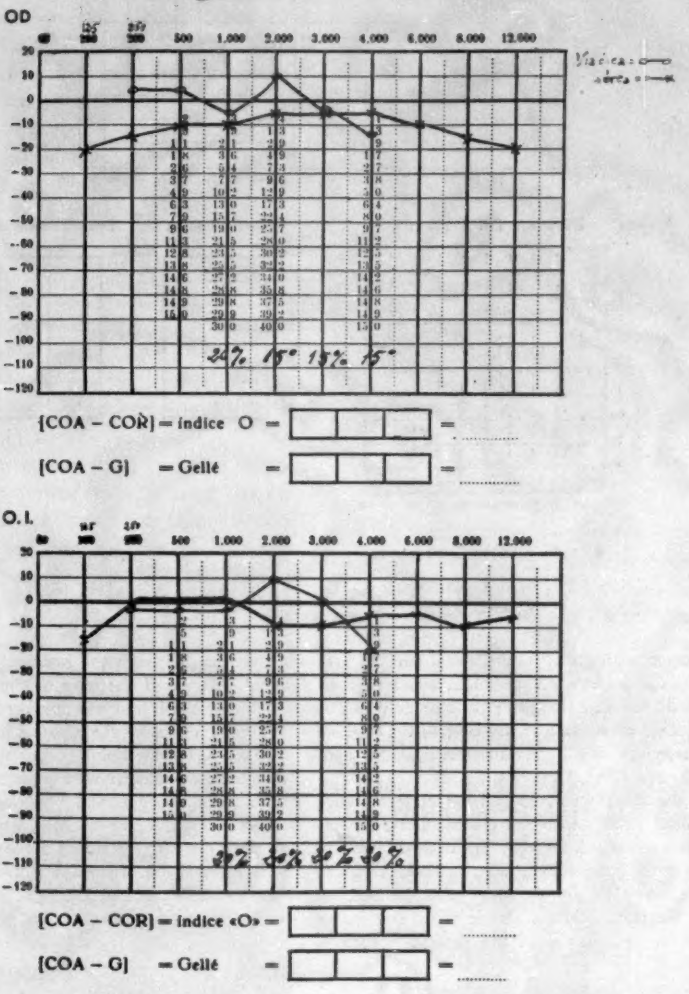
Hospital Clínico San Cecilio.—Cátedra de Otorrinolaringología
Enfermo Mª Angustias Crespo Suárez Fecha exploración 27-III-54
Realizó audiograma Dr. Mathieu Diagnóstico Atresia coanal derecha (Mask. 30 db)
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Fig. 5 (above). Fig. 6 (below).

for both the right and the left ear, and the reactions of Lüscher and Fowler were normal (Figs. 5-7).

Consequently, the diagnosis was established as congenital choanal atresia in the right side of the nose.

Operation.—With the patient under general ether anesthesia induced by intubation through the left nasal fossa, Rose position, the choanal imperforation was removed according to the transpalatine technique, on March 15, 1954. We did the incision from the second right molar down to the corresponding left one, very near the dental arch, to avoid damage to the vascular peduncle (Fig. 8).

With a palate elevator, the mucoperiosteal flap limited by the incision was separated with special

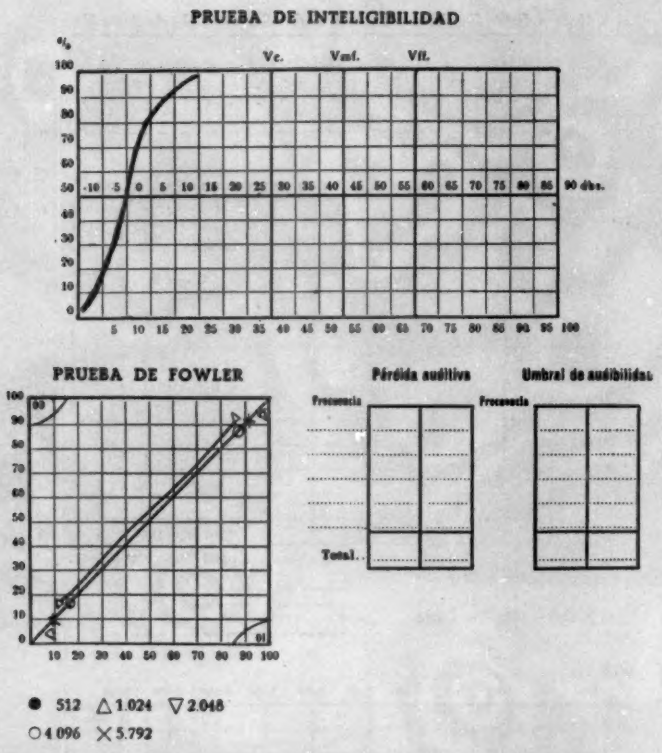


Figure 7

care in approaching the posterolateral part, to prevent affecting the vascular peduncle, which must be included in the flap to assure its nutrition and to prevent later cicatrization and necrosis. This also allows removal of all the horizontal palatal apophysis desired (Fig. 9).

Once the detachment reached the posterior edge of the hard palate, with the electric burr, the incision was enlarged through the external side to the pterygoid bone, which was partially removed with the burr. We did the same with the external wall of the choana in the atresic zone, that is, we reduced the prominence of the vertical branch of the palate. Through the internal side we removed about 0.5 cm. of the base of the left nasal fossa, disclosing the inferoposterior border of the vomer. We then removed the choanal obstruction. Once this was done, the lining of this zone of the septum was detached as if we were going to make a Killian submucous resection, and a portion of the bone was removed. Of the two mucosas, we removed the one on the right side, retaining the one on the left side with the purpose of turning it and laying it on the raw surface caused by the resection of the stenosis (Figs. 11-16).

Fig. 8 (left). Fig. 9 (right).

A thick drainage tube was placed so as to maintain the flap of nasal mucosa in position over the raw surface. Once this was in place, we restored the palatal flap and sutured it by interrupted nonabsorbable surgical (silk) sutures (Figs. 17 and 18).

Course.—The postoperative course was normal. The drainage tube was removed after 48 hours, and 5 days later the patient was discharged, with good breathing through the right nasal fossa—as she said, "better than with the healthy side."

Twenty days later another set of x-rays was made with contrast medium in the lateral and Hirtz positions (Figs. 19 and 20) and with a No. 20

rubber catheter filled with barium (Figs. 21-23), demonstrating the perfect permeability of the right nasal fossa.

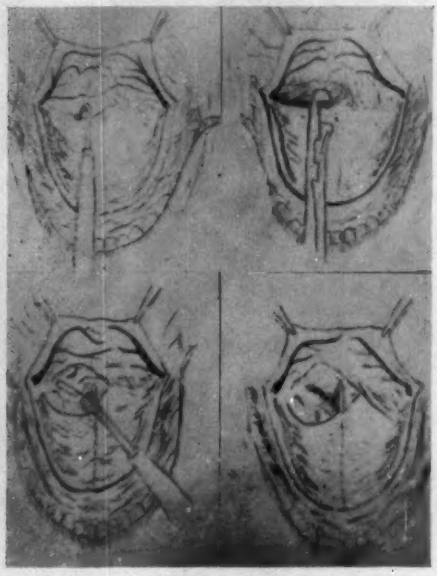
EMBRYOLOGICAL DEVELOPMENT

We have considered this case to be one of a congenital anomaly, thus justifying presentation of a brief review of the embryological development of the nasal fossae and, especially, of the choanae, to enable us to catalogue this case.

In the 2 mm. embryo, corresponding to the second week of intrauterine life, the stomodeum, or primitive mouth, is limited by the frontal process and on both sides by the superior and inferior prolongation of the first branchial arch. It ends in a pocket which corresponds to a similar one formed by the foregut, the ectoderm and the endoderm remaining in contact at this point and in this way forming the buccopharyngeal membrane.

In the following week, there begin to appear in this membrane some openings which, becoming confluent, cause the disappearance of the middle and interior part of the membrane and leave only a very short narrow veil with a free border beneath the cerebral

Fig. 10 (upper left). Fig. 11 (upper right). Fig. 12 (lower left). Fig. 13 (lower right).



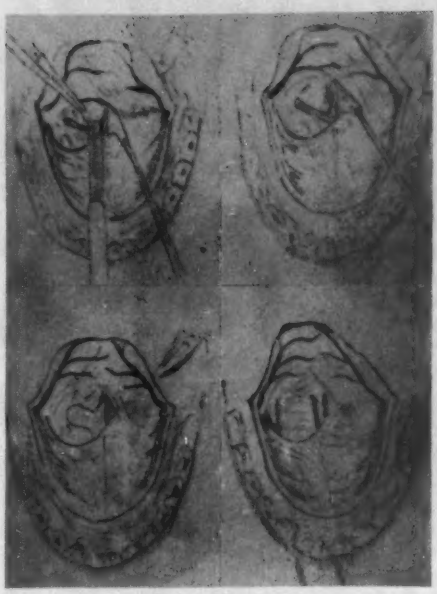


Fig. 14 (upper left). Fig. 15 (upper right). Fig. 16 (lower left). Fig. 17 (lower right).

vesicles, the primitive pharyngeal veil, which lines two depressions, an anterior one, the Rathke pouch, and a posterior one, the Seessel pouch. This veil, after persisting for some time, disappears, joining the mouth fissure with the foregut, or floor of the cephalic sac, producing in this way the naso-buccopharyngeal channel. If we superimposed in the adult an imaginary sketch of this buccopharyngeal membrane, we would find that it goes from the pharyngeal hypophysis to the inferior dental arch (Keith [59]).

In the 4 mm. embryo, on both sides of the frontal prolongation the ectoderm en-

Figure 18

Figure 19

Figure 21

Figure 20

Figure 22

Figure 23

larges, creating the olfactory placodes. A short time afterward these placodes invaginate, more through outgrowing of their borders than through deepening of their floor. Their circumference expands, and as a result a furrow is formed on the inferior side, the nasal furrow, which leads from the fossa to the entrance of the buccal cavity. Therefore, limiting this furrow, there are two processes on each side in the primitive frontal process, the internal and the external nasal processes. This state exists for only a short time, because the internal nasal process rapidly joins the supramaxillary process. In this way the primitive superficial communication of the nasal fossa with the stomodeum disappears.

As a consequence of the invagination of the olfactory plate, the base of the olfactory sac corresponds in the 6 mm. embryo to the ceiling of the primitive mouth. In the beginning it is separated by a certain quantity of mesoderm (Fig. 24), becoming thinner until only the epithelium of the olfactory fossa remains in contact with that of the mouth, forming a little diaphragm, Holstetter's bucconasal membrane, which on perforating later establishes a communication between the olfactory fossa and the buccal cavity, and this forms the primitive choanae, separated by the frontal process, which forms the primitive septum (Fig. 25). At this stage, which corresponds to the beginning of the second month, the nasal fossae are open at the two ends, the vestibular and the primitive choanal, and are separated by the frontal process, which will form the septum.

The superior submaxillary branch on each side, proceeding from the first arch, not only develops to the exterior but in the interior forms a plate, Kölliker's palatal plate, which, uniting in the midline with the one from the opposite side and in front with the internal process of the frontal process, forms the superior maxillary, the palate, and the internal side of the pterygoid apophysis. Thus, the definitive choanae are

Fig. 24.—Human embryo, 9.5 mm. Sagittal section through olfactory vesicle. (*1*) Primordial choana; (*2*) mouth cavity; (*3*) nasal epidermal plug; (*4*) primitive palate; (*5*) tongue; (*6*) inferior maxilla; (*7*) cervical vertebra.

Fig. 25.—Human embryo, 11 mm. Sagittal section through primitive choanae. (*1*) Olfactory vesicle; (*2*) nasal epidermal plug; (*3*) primitive palate; (*4*) tongue; (*5*) inferior maxilla; (*6*) primitive choana.

circumscribed, as an extension back of the primitive choanae.

The primitive choanae disappear as a consequence of the development of the olfactory labyrinth. However, they can be recognized in the adult, in the form of a narrow fissure ascending from down to up and front to back whose limits are as follows: In the front, the incisive duct, or Stensen's duct, when it exists, and, when this is missing, the middle part of the suture of the horizontal branch of the superior maxilla with the intermaxillary bone; on the inside, a line in form of an ascending crest parallel to the superior border of the vomer, on its articulation with the quadrangular cartilage and with the vertical branch of the ethmoid; at the back, a bone protuberance immediately below the sphenoid ostium, and outside, a line parallel to the one described on the wall, faultily drawn by the development of the ethmoid labyrinth and the protuberances of the turbinates (Kölliker [6]) (Figs. 26-29).

In the development of the definitive choanae, the following elements participate: (1) the palatine and pterygopalatine processes, proceeding from the superior maxillary process of the first arch; (2) the anterior sphenoid, from the chondrocranium; (3) the frontal process.

The development of the internal plate of the pterygoid apophysis, the palate, and the superior maxillary is accomplished at the expense of the superior maxillary branch of the first branchial arch. There is no previous cartilaginous stage; therefore, they must be considered as membrane, or revestment, bones. The three bones appear developed at the end of the second month, by means of a point of ossification for the pterygoid, producing the pterygoid bone, a thin osseous plate which later becomes united with the sphenoid body. The palate develops from two primitive ossification points which appear after a month and a half: the posterior point forms the pyramidal apophysis, while the further one forms the rest of the bone, with the exception of the sphenoidal apophysis and the bones of the orbit which proceed from two secondary points that do not appear until some time after birth. At the same time, several other points of nuclei appear for the superior maxillary, which

Fig. 26 (above). Fig. 27 (below).

Fig. 28.—Human embryo, 40 mm. Sagittal section through secondary choanae. (*1*) Primitive nasal cavity; (*2*) mouth cavity; (*3*) upper lip; (*4*) tongue; (*5*) secondary choana; (*6*) primary choana; (*7*) lower turbinate; (*8*) secondary palate; (*9*) secondary nasal cavity; (*10*) sphenoid.

then join and correspond to the subvomerian bone. Thus, they constitute the lateral and inferior walls of the choanae.

The anterior sphenoids belong to the chondrocranium, and, therefore, there is a previous cartilaginous stage in their formation. In this cartilage, by the third month of fetal life, several ossification points appear, which, joining together, form the body of the same. On the other hand, ever since the work of Virchow, we know that the intersphenoidal cartilage persists until the sixth month and is continuous with that of the rostrum sphenoidale and with that of the nasal fossa. It forms the superior wall of the choana.

From the frontal or septal process the vomer develops, which is the membrane bone of the anterior cranial wall. It has no previous cartilaginous stage (Kölliker[6]). The vomer appears by the third month in two parts which soon join together.

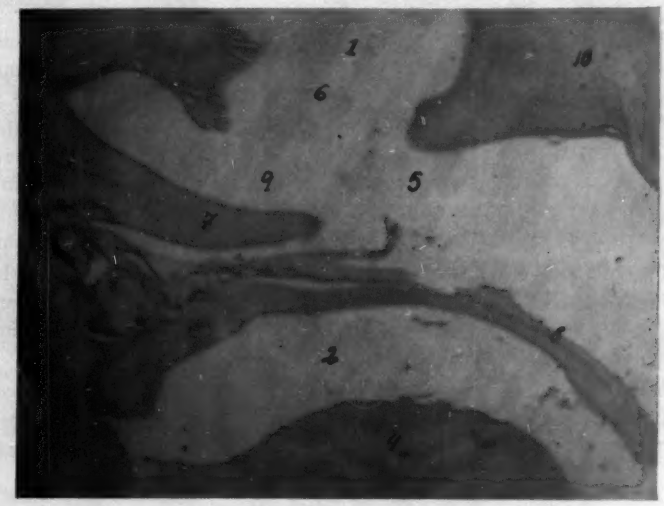


Fig. 29.—Human embryo, 40 mm. Sagittal section through the choanal midline. (*1*) Primitive nasal cavity; (*2*) mouth cavity; (*3*) upper lip; (*4*) tongue; (*5*) secondary choanae; (*6*) primary choanae; (*7*) inferior turbinate; (*8*) secondary palate; (*9*) secondary nasal cavity; (*10*) sphenoid.

Fig. 30.—Human embryo, 24 mm. Frontotransversal section through secondary choanae. (*1*) Septum; (*2*) nasal capsule; (*3*) turbinate; (*4*) palatine plate; (*5*) tongue; (*6*) mouth cavity; (*7*) secondary choanae.

We may draw one conclusion from this brief exposition of the development of the secondary choanae: "There is only one wall of the choana which has a previous cartilaginous stage, the superior wall." Therefore, finding cartilage as a cause of the choanal imperforation will be very uncommon, as we have already seen, and when it is found it will be located near the superior wall. Boyd [7] reported the same conclusion.

Another obvious conclusion is that the primitive choana remains very much in front of and above the definitive nasal fossa and that, therefore, its anomalies have nothing to do with the etiology of choanal imperforation.

Thus, the embryonal choanae, at first narrow (Fig. 30) and afterward slowly enlarging, arrive at their definitive aspect in the adult, and according to the original concept of Escat,* later taken up by Mouret and Cazejust,† they look like cylindrical, slightly funnel-shaped, channels with irregular walls, delimited by two planes of division. The anterior plane, from the frontal direction, extends obliquely from bottom to top and from forward backward, limited above by the sphenopalatine opening and below by the maxillopalatine suture. The posterior plane, parallel to the one already described, passes above the posterior border of the internal wing of the pterygoid apophysis and below by the posterior border of the horizontal plate of the palatal bone. Consequently, in accordance with the above-mentioned concepts, the choanal channel forms a double infundibulum in which the middle point of union of the two planes just mentioned corresponds to the minimum transverse diameter. It is just at this point, in front of the principal choana, that malformations occur and that the imperforation observed by us was situated.

After analyzing these embryological facts, we pass on to review the different theories advanced to explain this anomaly, and we shall try to catalogue the one which is the subject of this communication.

In principle, all the theories agree on the embryonal origin and differ in fixing the embryonal formation responsible for the anomaly.

In the first place, Jacques ‡ thought it to be an anomalous development of the cephalic extremity of the skeletal axis, prob-

* Cited by Terracol.[24]

† Cited by Terracol.[24]

‡ Cited by Terracol.[24]

ably due to congenital syphilis, and in favor of this opinion are the frequent observations of concomitant malformations of the facial mass. However, the influence of heredosyphilis is very doubtful, and in the published cases stigmas of congenital syphilis are exceptional.

This thesis, defended especially by the French authors, is similar to those which they advance for any other malformation. Syphilis seems to be used to explain everything which is not quite clear.

Nevertheless, two facts must be considered in this respect: (1) syphilis as a result of the new ideas of diagnosis and treatment is becoming less frequent, while reports of this deformity are increasing, and (2), even if we do not take into account tests as sensitive as the index of reagins (Nelson), it is no longer possible to speak of a congenital syphilitic influence without first considering specific serological reactions. Of course, in our case they were absolutely negative.

According to one group of authors, among them Schaeffer,[8] Boyd,[7] Schwartz and Isaacs,[9] Boulay,[10] and Haag,[11] the alteration originates from the persistence of the bucconasal membrane. The mesoderm remains between the nasal and the pharyngeal epithelium, so that whether the atresia will be membranous or bony depends on the thickness of the mesodermal remnant.

This theory does not seem completely valid, because the membrane of Holsstetter remains far in front of the nasal fossa and has nothing to do with the development of the secondary choanae. Moreover, the primitive nasal fossa and its corresponding choana represent the perforation in the buccal cavity of the floor of the olfactory sac, purely sensorial, while the definitive ones arise as a consequence of an additional function, the respiratory. Thus, it is not strange that in our case we found a completely normal olfactory potential and that after operation olfaction of the originally atresic fossa was practically the same as that of the healthy one.

Escat,§ Ducuing,[12] and Tourneux [13] believed that the membranous type of the anomaly, which affects the posterior extremity of the choana, should be attributed to persistence of the buccopharyngeal membrane or to its residuum, the primitive veil. Mouret and Cazejust ‖ contradicted this theory and stated that though its persistence has been noted in certain animals, sometimes intact and sometimes perforated, it has been observed that it is located far behind the choanae and at the level of the tubal orifice. The primitive palatal veil is, then, a pharyngeal formation located behind the choanae and would not be involved in its perforation (Fig. 25). This explains the situation which Kayser called retrochoanal atresia, of which Alonso [56] described a case in 1921.

The majority of authors make statements in favor of proliferation of the nasal skeleton, but they differ concerning the bone in which such proliferation occurs: Thus, Dasque [14] speaks of exostosis of the vomer and von Luschka,[15] of the horizontal plate of the palate, while Sieur and Rouvillois [16] decided that all the bones participating in the formation of the secondary choana, together, were responsible when the differentiation of the various points of ossification was disturbed.

From all these considerations we must deduce, at least in our case, that the theories invoking an exaggerated proliferation of the retronasal elements are the most valid, and that the tendency toward proliferation of a certain element is transmitted as a dominant character according to the Mendelian laws. This would explain the cases reported with a marked family history. Thus, Stewart,[18] in 1931, presented a case of bilateral atresia in two brothers; Lang [19] described the case of a boy whose mother, sister, maternal aunt, and probably a brother showed bilateral choanal atresia. Wilkerson [20] reported a case of complete bilateral atresia in three sisters. McGovern,[21] in 1950, presented a case of a mother and her daughter.

§ Cited by Terracol.[24]

‖ Cited by Terracol.[24]

Cabaniss ¶ reported the case of a family in which the deformity was evident in a woman and her twin children, and Dickson [58] recently described two cases of bilateral atresia in twins.

In our case we could not find a history of previous similar familial deformities.

According to the opinion of the majority of the authors, in unilateral cases there seems to be a special predilection for the right side; Durward, Lord, and Polson [26] found an average of 60% of right-sided cases among those studied by them.

The condition is more frequent in the female. Fraser,[57] among 85 cases, found 31 men and 54 women; Kahler,[55] among 9 cases, found 8 women and 1 man, and Hamilton,[56] among 4 cases, found 3 women and 1 man.

Although in our patient the imperforation was totally osseous, which is certainly the most frequent type, membranous, cartilaginous, and mixed imperforations may also be found. Sometimes muscular fibers have been observed (Schwendt [22]) as well as lymph nodes and follicles (Chiari [23]).

Terracol [24] reported 65 cases, 51 of osseous type, 7 of membranous type, and 7 partly membranous and partly osseous. In agreement are Wright, Shambaugh, and Green [25] and Durward, Lord, and Polson,[26] who give the figure of 90% of the osseous type.

In the literature we have reviewed, we have found only two cases of the cartilaginous type, those of Onodi [27] and of Richter.#

Although in our case the imperforation was in the narrowest portion of the choanal infundibulum, which is the most frequent finding, the anomaly can be situated in the frontal plane, which limits the choanal orifice in the front and is the one called by Mouret and Cazejust * "anterior marginal occlusion," or in the posterior plane of the choana, that is, in its pharyngeal border, corresponding to what these authors have called the "posterior marginal occlusion."

The thickness of the obliteration is frequently very small, scarcely 2 mm. in our case. When it is much larger, we tend to agree with Terracol [24] that added malformations exist which go beyond the choanal boundaries.

On the nasal side, the imperforation is covered by the pituitary, and on the pharyngeal side, by its corresponding mucosa. Some authors, among them Beyer and Blair [28] and Blair,[29] found small perforations, but we did not find any in our case.

In the unilateral cases, as was ours, the most frequent finding is a deviation of the partition from the front backwards, toward the obliterated fossa. The other mentioned alterations, such as prominence of the sinus wall in the nasal fossa, elevation of the corresponding half of the palatal arch, etc., could not be observed in the examination, either by radiography or during the actual operation.

It is worthy of attention in our case that the girl's family noticed so soon that she did not breathe through the right nasal fossa. Certainly this observation is not frequent, perhaps for the reason that the unilateral condition in many cases disappears in early infancy. However, when the deformity is suspected, it might be useful to make the Daubret test, as modified by Ducuing,[12] in which the air passing through one nasal fossa to the other is controlled; one end of a rubber tube is introduced through a naris, and the other end is submerged in a glass of water. When air is insufflated through the other nasal fossa, bubbles will be produced on the surface of the water in the case of permeability.

In adults or older children, radiographic exploration gives more conclusive data, as is shown in the plates we present in the lateral Hirtz positions. The obstruction can be seen in the lateral view. The extension and grade of stenosis can be seen more accurately with the instillation of iodized oil. With radiography in the Hirtz position,

¶ Cited by McGovern.[21]

Cited by Terracol.[24]

* Cited by Terracol.[24]

it is easy to determine the existence of a right unilateral atresia, the appearance of the infundibulum, and the deviation of the nasal partition to the affected side.

With reference to olfactory alterations, it is easy to understand that anosmia may be found in bilateral cases, while it is generally not noted in the unilateral cases. However, the olfactory capacity seems to be preserved, and it is frequently the case—and our case is a proof of this—that the patient has subjective cacosmia as a result of a chemical excitation of the olfactory epithelium. It is not strange that once nasal permeability was reestablished the perception of smells was normal for our patient.

In the radiograms we could not observe alterations in the development of the paranasal sinuses. This is also the opinion of McGovern,[21] Ersner,[20] and Owens,[53] who clearly established that there is no influence on the development of these cavities. In 47 cases gathered by 25 observers, 46 exhibited clinical or x-ray evidence of a normal sinus development, regardless of whether the cases were unilateral or bilateral. The percentage of infection, these authors add, does not seem to be much greater than that for normal persons. However, previously great attention was paid to choanal imperforation as producing mucous stagnation on the affected side, leading without exception to sinus infection (Grove[31] and Dean[32]).

Proetz[33] established the existence of a remarkable difference between the nasal mucosa which is deprived of air after the nasal fossa has been permeable for some time and that in which the fossa has never been permeable. In the latter case, normal mucosa has been found. This makes us believe that all the alterations described as depending on choanal atresia may be reduced to only the coexistence of malformations and developmental delays.

With reference to the otic influence, otoscopy and x-rays in the Schüller position, as well as the audiograms for our patient, are normal. From a review of the literature, we might also deduce that an effect on the ear is not frequent in cases of congenital choanal atresia.

In any case, most authors point out that in spite of the tympanic membrane being enlarged and sometimes destroyed there is no effect on the auditory capacity. Neither does the development of mastoid pneumatization seem to be affected (Ersner[20]).

Owens[53] affirms that the palatal arch on the obstructed side is more elevated than that of the unaffected side in practically every case. In our case, there was no facial asymmetry, nor did we observe any difference in the elevation between the hemipalates. No other congenital deformity was noted to coexist with the atresia. However, Binnerts[34] described a double tragus on each external ear of his patient. Thomasson[17] reported a congenital coloboma of the iris. Stinson[36] and Kazanjian[8] stated that they had observed facial asymmetry in some cases and mental weakness in others. McGovern[54] recently presented a case with coexistent congenital cardiac anomalies. He reported on two patients, one with persistence of the arterial duct and the other with perforation of the interventricular wall.

Headaches are very frequent, as they were in our patient, disappearing as soon as the nasal fossa has become permeable.

TREATMENT

Let us proceed to the very important aspect of the problem, surgical treatment.

Since Emmert,[37] in 1853, surgically treated the first reported case of bilateral choanal atresia by using a trocar to puncture the imperforation, different techniques have been used.

In 1885, von Schrötter[38] created an opening by means of galvanocautery combined with chemical cauterization. In 1886, Hubbell[39] utilized a hand drill for the same purpose. In 1907, Borse,† in a patient 22 years old, made the resection of the obstruction with a trocar, chisel, and saw, followed by the insertion of a rubber tube into the opening. In the following year,

† Cited by Bonham.[60]

Uffenorde [40] made the perforation using a chisel and curet, dissecting a septal flap to cover the denuded bony surface.

Katz, Preysing, and Blumenfeld,[41] in 1911, in addition to the chisel and curet, used a rongeur to remove the posterior wall of the vomer. In 1913, Richardson [42] performed a submucous resection to approach the atresia and then removed the posterior third of the septum, a procedure followed by numerous authors, among them Tarasido,[61] Fernandez Vatilla, Kahler.[35]

Blair,[29] in 1931; Ruddy [43] and Klaff,[44] in 1945, and Aboulker,[45] in 1951, approached the atresia by a transpalatine route, following the concept advanced by Brunk,[46] in 1909.

Stinson,[36] in 1932, resected part of the vomer in a girl 14 years of age with right-sided choanal atresia, thus permitting communication and drainage of the right nasal fossa into the left one.

Colver,[47] in 1937, called attention to the difficulty of maintaining the patency of the newly created choanae, a problem mentioned by Roberts,[48] Fernandez Seco,[49] and preceding authors. To prevent the closure of the opening, Blair [29] and Donnelly [50] advocated the use of a split skin graft which was wrapped around a catheter and applied to the denuded area.

Wright, Shambaugh, and Green [33] described an approach to the atresia through the maxillary sinus. They made a large opening in the anterior wall of the maxillary sinus as in a Caldwell-Luc operation, and outlined an aperture on the inferior meatus to uncover the atresia and the septum. Then they proceeded to removal of the atresia and the posterior part of the septum. They placed a thick drain in the nasal fossa up as far as the nasopharynx.

Beinfield,[5] in 1951, described an original technique, by the anterior route, which schematically consisted of an upward fracture of the inferior turbinate bone of the atresic cavity. Then, an incision was made to the bone of the maxilla, "just inside its anterior margin, on the floor of the naris, extending from the outermost lateral margin and carried along the floor of the nose to the septum and then half way up the septum." Afterward he elevated the mucoperiosteum on the floor of the nose and on the septum all the way back to the atresia. The mucosas were separated, and a long Killian nasal speculum was introduced, exposing in that way the choanal imperforation at the posterior naris, which was removed with a gouge. A stellate incision was made in the pharyngeal mucosa. The nasal mucoperiosteum corresponding to the imperforation was replaced. The luxated turbinate was replaced, and a large catheter was passed through the new choana. Beinfield claimed to have obtained very good results with this technique.[51]

Therefore, we can summarize the approaches for resection of the atresia as follows: anterior, or transnasal; transseptal; transinusal, and transpalatine.

Analyzing the different techniques used, we consider that, although immediately they all give a satisfactory result, relapse is frequent, and the concern of all the authors is to avoid posterior occlusion of the perforation by cicatricial tissue. One attempt to avert this has been a large resection of the choanal walls and the subsequent implantation of grafts.

Of all the recommended techniques, the transpalatine approach offers undoubted advantages that, according to Baker,[52] may be summarized as follows:

(1) the operation is performed under direct, open vision, (2) permanency of the window is made possible by the removal of the posterior border of the septum, and the chances of success are further enhanced by removing the base, the adjacent hard palate [To this we should add that in the cases, like ours, in which the resection or reduction of the external choanal wall is necessary, this approach provides the greatest safety for the sphenopalatine vessels, as there is direct vision of the operative field. This purely surgical fact does not permit us to state that the stenosis will not recur as with the other techniques, but we believe that recurrence is less probable. We believe this because the time after which the ultimate results of the operation could be determined was reduced in our case to four months

after the intervention], and (3) a flap of membrane is preserved and manipulated to cover the raw surface.

The application of this mucous flap in the denuded area resulting from resection of the stenosis is indisputably a factor in avoiding excessive development of cicatricial tissue in the healing zone. We cannot forget, however, that with such a technique the nasal surface of the soft palate can be an element which, on granulating near the resections made in the external surface, may produce a postoperative stenosis. We have no personal experience with this, nor do other authors mention it, but it must be considered as possible.

Owens [58] asserts that the transpalatine approach, in addition to the above-mentioned advantages, permits intervention at a very early age.

From the technical point of view, it is easy to operate at such a young age. To this has been opposed the argument that the removal of so much tissue in the child may in itself retard the development of the nasal fossa. Owens asserts that a year after the intervention he palpated the posterior border of the hard palate and found it difficult to discern any difference between the operated and the healthy sides. In the same manner, removal of a good portion of the vomer does not seem to interfere with development of the nose, as has sometimes been supposed, and oral surgeons remove a great section of the vomer to force back the premaxilla in cases of hare-lip. In the case Owens described and observed there was normal facial and nasal development five years after the operation.

Baker [52] presented two cases with operation through the intranasal route in which a new operation was needed after 2½ and 15 months, respectively. In his summary he stated:

The fact can be emphasized that the intranasal approach, though successful, is not too satisfactory in that it requires a great deal of time and aftercare on the part of the surgeon and brings considerable discomfort to the patient. Possibly the transpalatine procedure will be the operation of choice in the future.

Since we ourselves had already made four interventions in choanal atresias by the transnasal route and were obliged to reoperate in one case after four months, we could appreciate the above-mentioned advantages of the transpalatine approach, which are not to be found in other techniques.

In addition, we believe that, in the unilateral cases, the more complete the development of the nasal fossa is the fewer are the possibilities of recurrence.

We believe that in children under 4 years of age it is not advisable to intervene in cases of unilateral atresia, more because of the operative difficulties than because of the possibility of ultimate disturbances in development.

In the cases in which the external choanal wall is affected, it can be cautiously attacked with greater safety with the electric drill to avoid damage to the sphenopalatine peduncle, which is situated below and outward in the operative position.

Hemostasis of the flap is easily secured at the moment the vascular pedicle is clamped.

We maintain the drainage tube in position for 48 hours to assure the coaptation of the mucosal septal flap over the denuded operative area. It seems unnecessary to maintain drainage for a longer time. The placement of this tube makes unnecessary the suture of the flap recommended by Owens.[58]

The absence of instrumental manipulation inside the nasal fossa represents, as one might assume, a favorable factor in regard to prevention of cicatrization of the atresic zone as well as in averting adhesions, which formerly occurred in this zone, as has been observed occasionally with the transnasal techniques.

REFERENCES

1. Otto, A. W.: Lehrbuch der pathologischen Anatomie des Menschen und der Thiere, Berlin, A. Rücker, 1830.

2. Ronaldson, T. R.: Note on a Case of Congenital Closure of the Posterior Nares, Edinburgh M. J. **26**:1035, 1880-1881.

3. Kazanjian, V. H.: Treatment of Congenital Atresia of the Choanae, Ann. Otol. Rhin. & Laryng. **51**:704, 1942.

4. Cinelli, A. A.: Nasal Atresias: A Surgical Critique, Ann. Otol. Rhin. & Laryng. **49**:912, 1940.

5. Beinfield, H. H.: Treatment of Complete Unilateral Bony Atresia of the Posterior Nares: New Technique and Brief Reference to Asphyxia Neonatorum, A. M. A. Arch. Otolaryng. **53**:530, 1951.

6. von Kölliker, A.: Embryologie: Traité complet du dévelopment de l'homme et des animaux supérieurs, Paris, C. Reinwald & Cie, 1882.

7. Boyd, H. M. E.: Congenital Atresia of the Posterior Nares: Descriptions of Technics Used in Meeting Operative Difficulties and Report of Case, Arch. Otolaryng. **41**:261, 1945.

8. Schaeffer, J. P.: .The Lateral Wall of the Cavum Nasi in Man, with Especial Reference to the Various Developmental Stages, Ann. Otol. Rhin. & Laryng. **20**:277, 1911.

9. Schwartz, A. A., and Isaacs, H. J.: Congenital Atresia of Posterior Nares: Report of 2 Cases, Arch. Otolaryng. **35**:603, 1942.

10. Boulay, M.: Étude clinique sur l'occlusion complete et congénitale de l'orifice postérieur de la fosse nasale droite, Ann. mal. oreille, 1902, p. 140.

11. Haag, H.: De La Forme du squelette facial dans l'atresie congénitale des choanes, de l'étiologie et du traitement de cette anomalie, Thesis, Basle, 1899.

12. Ducuing, J.: L'Occlusion congénitale des choanes, Thesis, Toulouse, 1912.

13. Tourneux, F.: Précis d'embryoligie humaine, Paris, O. Doin, 1898.

14. Dasque, J. J.: Du Traitement chirurgical des malformations osseuses des fosses nasales (par les voies naturelles), Thesis, Bordeaux, 1898.

15. von Luschka, H.: Der Schlundkopf de Menschen, Tübingen, H. Laupp, 1868.

16. Sieur, M., and Rouvillois: Essai sur le dévelopment embryologique de la cavité naso-pharyngienne, Arch. internat. laryng. **33**:466; 792, 1912.

17. Thomasson, W. J.: Congenital Bony Occlusion of the Right Nasal Choana, Laryngoscope **25**: 221, 1915.

18. Stewart, J. P.: Congenital Atresia of the Posterior Nares, Arch. Otolaryng. **13**:570, 1931.

19. Lang, J.: Über Choanenatresie (Heredität derselben), Monatsschr. Ohrenh. **46**:970, 1912.

20. Wilkerson, W. W., Jr., and Cayce, L. F.: Congenital Choanal Occlusion, Tr. Am. Acad. Ophth. **52**:234, 1948.

21. McGovern, F. H.: Congenital Choanal Atresia, Laryngoscope **60**:815, 1950.

22. Schwendt, A.: Obliteration congénital des coanes, Cor.-Bl. schweiz-Ärtze, No. 7 (April) 1890.

23. Chiari, O.: Maladies des voies respiratoires supérieures: Maladies du nez, Leige, C. Desoer, 1905.

24. Terracol, J.: Les Maladies des fosses nasales, Ed. 2, Paris, Masson & Cie, 1953.

25. Wright, W. K.; Shambaugh, G. E., Jr., and Green, L.: Congenital Choanal Atresia: A New Surgical Approach, Ann. Otol. Rhin. & Laryng. **56**:120, 1947.

26. Durward, A.; Lord, O. C., and Polson, C. J.: Congenital Choanal Atresia, J. Laryng. & Otol. **60**:461, 1945.

27. Onodi, A.: Obliteration congénitale des choanes, Berl. klin. Wchnschr. **26**:742, 1889.

28. Beyer, T. E., and Blair, J. R.: Choanal Atresia, Laryngoscope **57**:719, 1947.

29. Blair, V. P.: Congenital Atresia or Obstruction of the Nasal Air Passages, Ann. Otol. Rhin. & Laryng. **40**:1021, 1931.

30. Ersner, M. S.: Operative and Postoperative Management of Bilateral Bony Atresia of the Choana, A. M. A. Arch. Otolaryng. **58**:96, 1953.

31. Grove, W. E.: Choanal Atresia and Sinus Infection, Arch. Otolaryng. **6**:237, 1927.

32. Dean, L. W.: Paranasal Sinus Disease in Infants and Young Children, J. A. M. A. **85**:317, 1925.

33. Proetz, A. W.: Essays on the Applied Physiology of the Nose, Ed. 2, St. Louis, Annals Publishing Company, 1953.

34. Binnerts, A.: Einseitige Choanalatresie bei einem Säugling von 3 Monaten, Arch. Laryng. u. Rhin. **34**:324, 1921.

35. Kahler, O.: Über kongenitale knöcherne Choanalatresie, Monatsscher. Ohrenh. **43**:41, 1909.

36. Stinson, W. D.: Osseous Atresia of the Posterior Choanae, Arch. Otolaryng. **15**:101, 1932.

37. Emmert, C. F.: Lehrbuch der Chirurgie, Stuttgart, F. v. R. Dann, 1853.

38. von Schrötter: Über angeborenen knöcheren Verschluss der Choanen, Monatsschr. Ohrenh. **19**: 97, 1885.

39. Hubbell, A. A.: Congenital Occlusion of the Posterior Nares, Buffalo M. & S. J. **26**:193, 1886-1887.

40. Uffenorde, W.: Ein Fall von Choanalatresie mit Demonstrationen, Ztschr. Laryng. Rhin. u. Otol. **1**:475, 1908.

41. Katz, L.; Preysing, H., and Blumenfeld, F.: Handbuch der Speziellen Chirurgie, des Ohres und der oberen Luftwege, Leipzig, Curt Kabitzach, 1911, Vol. 3, p. 432.

42. Richardson, C. W.: Congenital Occlusion of the Post-Nasal Orifices, with Report of a Case, Tr. Am. Laryng. A. **35**:226, 1913.

43. Ruddy, L. W.: Transpalatine Operation for Congenital Atresia of Choanae in Small Child or Infant, Arch. Otolaryng. **41**:432, 1945.

44. Klaff, D. D.: Bilateral Congenital Atresia of the Choanae, Arch. Otolaryng. **41**:298, 1945.

45. Aboulker, P.: La Voie d'abord palatine dans les interventions sur les choanes, le cavum et éventuellement la sphenoïde, Ann. oto-laryng. **68**: 255, 1951.

46. Brunk, A.: Ein neuer Fall von einseitigem knochernem Choanenverschluss: Operationsversuch vom Gaumen aus, Ztschr. Ohrenh. **59**:221, 1909.

47. Colver, B. N.: Congenital Choanal Atresia: Two Cases of Complete Bilateral Obstruction, Ann. Otol. Rhin. & Laryng. **46**:358, 1937.

48. Roberts, G. J.: Congenital Choanal Atresia, U. S. Nav. M. Bull. **43**:1216, 1944.

49. Fernandez Seco: Oclusión bilateral de las coanas de origen congénito, Rev. españ. y am. laring. otol. y rhin. **16**:291, 1925.

50. Donnelly, J. C.: New Method of Operation for Congenital Atresia of the Posterior Nares, Arch. Otolaryng. **28**:112, 1938.

51. Beinfield, H. H.: Unilateral Congenital Incomplete Bony Atresia of the Posterior Nares (Choanae), A. M. A. Arch. Otolaryng. **59**:65, 1954.

52. Baker, M. C.: Congenital Atresia of Posterior Nares, A. M. A. Arch. Otolaryng. **58**:431, 1953.

53. Owens, H.: Observations in Treating 7 Cases of Choanal Atresia by Transpalatine Approach, Laryngoscope **61**:304, 1951.

54. McGovern, F. H.: The Association of Congenital Choanal Atresia and Congenital Heart Disease: Report of 2 Cases, Ann. Otol. Rhin. & Laryng. **62**:894, 1953.

55. Dickson, J. C.: Congenital Atresia of the Posterior Nares, Texas J. Med. **46**:115, 1950.

56. Alonso, J. M.: Obstrucción congénito de las coanas, Rev. españ. y am. laring. otol. y rhin. **12**:206, 1921.

57. Fraser, J. S.: Congenital Atresia of the Choanae, Brit. M. J. **2**:1698, 1910.

58. Hamilton, T. K.: Bony Occlusion of the Choanae, J. Laryng. **20**:172, 1905.

59. Keith, A.: Human Embryology and Morphology, Ed. 6, London, Edward Arnold & Co., 1948.

60. Bonham, W. L.: Congenital Choanal Occlusion, South. M. J. **35**:252, 1942.

61. Tarasido, A.: Rev. españ. y am. laring. otol. y rhin. **12**:213, 1921.

Paranasal Sinus Changes in Fibrocystic Disease of the Pancreas

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In the past several years, the Department of Otolaryngology of the Babies Hospital has been requested to see many children with nasal symptoms who had previously been diagnosed as having fibrocystic disease of the pancreas. These children had various nasal complaints, but particularly nasal suppuration and obstruction. All cases that were examined were found to have chronically diseased paranasal sinuses.

The entity of sinusitis and bronchiectasis is well known, but in reviewing the literature of fibrocystic disease it was found that the paranasal sinuses were not, as a rule, included in the list of structures affected. Only Bodian[1] in his work on fibrocystic disease showed pathological studies of the entire respiratory tract, including the sinuses, and demonstrated that there were at times changes in nasal respiratory mucosa. Fibrocystic disease in the upper respiratory tract probably has gone unrecognized as such because the disease in the young child produces such obvious symptoms in other systems that they demand the entire attention of the pediatrician. The relatively high death rate in the past in young children with the fibrocystic and pulmonary manifestations of this disease has also not allowed the nasal symptoms to become manifest in many cases.

For the otolaryngologist to understand the role of sinus disease in these patients, a brief review of the generalized disease is essential. Fibrocystic disease is not uncommon. It occurs approximately once in every 600 to 1000 births and has been found in 3% of unselected pediatric autopsies.[2]

The exact cause of the disease is unknown, but there are three basic theories on its etiology. One group adheres to the theory that autonomic imbalance with parasympathetic dominance is the key to the disease. Another group believes that prenatal pancreatic infection of some type occurs which eventually produces pancreatic deficiencies and the resultant symptoms. The third group adheres to a theory of familial and congenital origin of the disease. The familial tendency has been amply demonstrated by many writers. Some of this group believe that the pancreas is the organ which is first genetically diseased and that all other pathology is secondary to pancreatic changes. Others believe that the disease is one of the primitive entoderm and that the pancreas is but one of the organs involved primarily.*

Regardless of etiology, the microscopic pathology in these cases presents an interesting picture with the unifying concept of excretory glandular dysfunction as a basis for all forms of the disease in all organs involved. In one of the accompanying photomicrographs a section of normal respiratory mucosa is shown (Fig. 1). A section of bronchus from a case of fibrocystic disease is shown (Fig. 2), which may be compared with similar findings in the membranes of the nasal

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From the Department of Otolaryngology, Babies Hospital of the Columbia-Presbyterian Medical Center, New York. Work supported by the Charles Hayden Fund for the Coakley Memorial Clinic. Photographs by V. Epanchin, M.D. Prof. E. P. Fowler Jr. assisted in the care of the patient and the preparation of the paper.

* References 3 and 4.

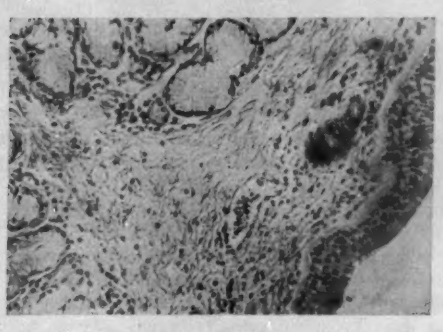


Fig. 1.—Normal respiratory epithelium.

chambers and sinuses from a case of fibrocystic disease (Figs. 3 and 4). There is a general hyperplasia of glandular structures with dilatation of glands. These glands seem to contain eosinophilic-staining material in excessive amount. I believe that this underlying pathology predisposes to infection and results in chronic sinusitis. Microscopically the appearance of this pathology is similar to a form of sinus disease described by Eggston and Wolff [5] as "chronic glandular and

Fig. 2.—A section of bronchial mucosa from a case of fibrocystic disease showing dilated glands and outpouring of thick secretions into the bronchial lumen.

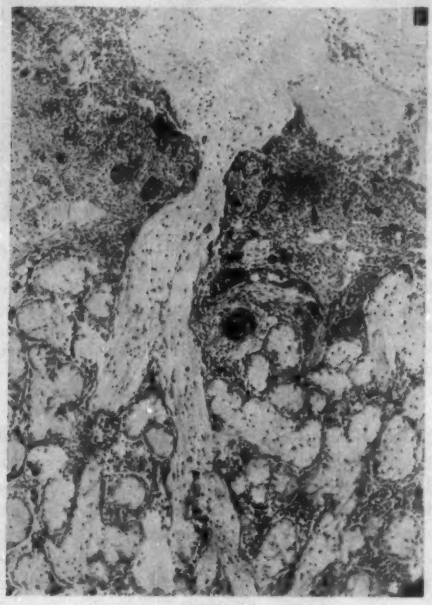
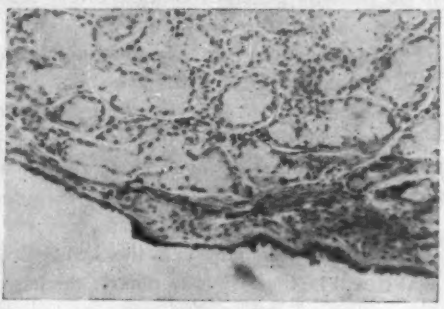


Fig. 3.—Mucosa of the left maxillary sinus of a case of fibrocystic disease. Note the increased number of glands, and their dilated lumens. Thick eosinophilic staining can be seen in some of the glands. The characteristics of the sinus mucosa and those of the bronchial mucosa are identical. (Tissue section from the Department of Pathology, Babies Hospital.)

cystic sinusitis." In the pancreas the pathology is the same, with dilatation of glands and subsequent replacement of acinar tissue with fibrous connective tissue.

From the clinical point of view, the disease is one of the newborn infant and the child. It may be manifest at or before birth by impaction of meconium secondary to a deficiency of normal intestinal mucus. Death in these cases results unless the obstruction is relieved surgically, and even if surgery is successful prognosis is poor. If the infant survives the first few months, then lower gastrointestinal and respiratory symptoms develop in the form of loose fatty stools, atelectasis, and recurrent bronchopneumonia. During this period nasal symptoms may become obvious in

Fig. 4.—A higher magnification of that shown in Figure 3. (Tissue section from the Department of Pathology, Babies Hospital.)



the form of obstruction and, more frequently, nasal suppuration. Diagnosis of the disease is confirmed in the laboratory by the finding of lowered trypsin levels in the duodenal secretions. Analysis of secretions from the sweat glands reveals sodium and chloride levels to be three or four times their normal value.[6]

Once the disease is diagnosed by the pediatrician, patients are prophylactically kept on low dosages of antibiotics to reduce the incidence of bronchopneumonia, which is the usual cause of death in these cases. Cultures from the bronchial and nasal secretions almost always yield Staphylococcus aureus, which, at times, becomes insensitive to all antibiotics after long periods of use. A low-fat diet is advocated by some because of the pancreatic enzyme deficiency.[2]

As children grow older there appears to be less infection of the nasal sinuses. Two children in adolescence have been examined, and though sinus disease was revealed by history and x-ray, there was no clinical evidence of sinusitis. Since the advent of antibiotics the natural history of the disease has been altered, and as yet it has not been followed through its entire course from birth to adulthood.

The role of the consultant otolaryngologist in these cases should be to establish a physiological nasal and bronchial airway, if possible, and to render conservative therapy to the sinuses in an attempt to reduce infection in this region to a minimum. The use of Proetz displacement and minor surgical procedures especially to promote antral drainage in these cases may afford some improvement in the patients' general condition. Every case of fibrocystic disease should have the benefit of sinus x-rays and an examination by an otolaryngologist. It is well known that antibiotics alone will do little to cure or control a chronic sinusitis. Thus, unless treated actively, the sinuses in many cases remain a hidden reservoir for the next lower respiratory tract infection. In this disease, however, one treats the patient with the knowledge that it will be impossible to remove the basic underlying pathology. The goal in this case is one of reducing infection to a minimum. Until we know something of the basic etiology, our attitude in therapy should be one similar to that assumed in the management of a case of atrophic rhinitis or severe nasal allergy—control but not cure.

An interesting case from the otolaryngologist's point of view is presented.

REPORT OF A CASE

The patient, a 6-year-old child, had been followed since 6 months of age in Babies Hospital, where

Fig. 5.—Waters position of the sinuses of a 6-year-old child with fibrocystic disease. The maxillary sinuses are larger than those normally seen in a 12-year-old child. Note the marked opacity of the antra and the lack of definition in the anterior ethmoidal groups. Large cysts we found to have destroyed the medial walls of both antra, the floors of the orbits, and the anterior ethmoidal cells.

he was diagnosed as a case of fibrocystic disease of the pancreas following a bout of bronchopneumonia. Duodenal trypsin levels were very low. During this first hospital admission some nasal obstruction was noticed as well as some excessive nasal discharge. The child was followed for the next three years. During this period, he had several additional

bouts with bronchopneumonia. X-rays of the sinuses at 3 years of age showed completely opacified maxillary sinuses. These sinuses appeared to be much larger than normal for a child of this age. The child's malar regions were found to be full and prominent on examination. Nasal obstruction was total, and the possibility of choanal atresia was considered. Iodized oil (Lipiodol) placed in the nose revealed the obstruction to be complete at the junction of the anterior and middle one-third of the nasal chambers bilaterally. Adenoidectomy was performed to eliminate additional obstruction in this area. Most of the obstruction, however, appeared due to enlarged middle turbinates. X-rays at 6 years of age showed even larger maxillary sinuses (Fig. 5). Nasal obstruction persisted, and the child had developed a severe pectus excavatum. Thoracic surgeons felt that surgical relief of this condition might be undertaken if nasal obstruction could be eliminated. The patient was admitted to the hospital for surgical correction of the obstruction by submucous resection of the middle turbinates. At operation (supervised by E. P. Fowler Jr., M.D.) the anterior tip of the left middle turbinate was incised, yielding 15 cc. of thick caseous material. The turbinate collapsed, having been cystically dilated. Closer inspection revealed the entire bony lateral nasal wall below the superior meatus to be missing, as well as the floor of the orbit. The incision was repeated on the right and a similar condition was found, the orbital floor also being absent on that side. It was assumed that bony destruction was produced by pressure from the huge cysts, which developed secondary to glandular dilatation. After operation the patient breathed through his nose for the first time and actually developed a sense of smell. Suppuration gradually decreased over a period of the next eight months, and the patient was able to sleep for the first time in a recumbent position. The nasal mucosa on examination at the end of 10 months appeared completely normal.

Study of nasal mucosa in this disease may prove to be an excellent means of recording the interval pathological changes in the disease in those who survive to late adolescence and adult life.

SUMMARY

A brief review of fibrocystic disease with its generalized manifestations is presented. The unifying concept of generalized excretory glandular dysfunction as a basis for the disease is discussed.

Nasal mucous membranes as well as those of the paranasal sinuses are involved in the pathologic process as are other respiratory membranes because of their glandular characteristics. Sinusitis at some point in the patient's illness should be expected in the majority of these cases.

Conservative therapy should be given in the chronic cases of sinusitis from this group.

REFERENCES

1. Bodian, M., Editor: Fibrocytic Disease of the Pancreas: A Congenital Disorder of Mucus Production—Mucosis, London, William Heinemann, Ltd., 1952.

2. Andersen, D. H.: Cystic Fibrosis of the Pancreas, in Holt Pediatrics, edited by L. E. Holt Jr. and R. McIntosch, Ed. 12, New York, Appleton-Century-Crofts, Inc., 1953.

3. Hughes, J. G.: Cystic Fibrosis of the Pancreas, J. Chronic Dis. **2**:224-231, 1955.

4. Morton, H.; Hennigar, G. R., and Sutton, L. E., Jr.: A Concept of Mucoviscidosis (Cystic Fibrosis of the Pancreas), Virginia M. Month. **80**:563-571, 1953.

5. Eggston, A. A., and Wolff, D.: Histopathology of the Ear, Nose and Throat, Baltimore, Williams & Wilkins Company, 1947.

6. Darling, R. C.; di Sant'Agnese, P. A.; Perera, G. A., and Andersen, D. H.: Electrolyte Abnormalities of the Sweat in Fibrocystic Disease of the Pancreas, Am. J. M. Sc. **225**:67-70, 1953.

Esthetic (Cosmetic) Surgery of the Face and Neck

Where Shall the Ear, Nose, and Throat Specialist Stand on the Question?

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Although cosmetic surgery was being done, and with good repute, before the advent of the Christian era,[1] it has been through succeeding periods of recognition and condemnation. During the years of the present century, the point of view has tended to be that there is an unethical element in the performance of an operation about the face and neck when the view of the patient is only to improve his personal appearance—an entirely mistaken idea.

Although the patient may not be at all aware of it, there is always something deeper than mere vanity behind any request for cosmetic surgery about the face, whether it is for improvement of the contour of a long or twisted nose [2] or a markedly retreating chin,[3] the removal of disfiguring scars, the correction of oversized and outstanding ears,[4] or a face-lifting operation.

In many such instances there are obvious reasons for a cosmetic operation, which may or may not be the restoration of disturbed physiological function, as is often the case with both congenital and acquired deformities of the nose, chin, and eyelids.

There is never any question about the desirability of a plastic operation on the nose when the airway is occluded by maldevelopment or by acquired deformity,[5] whether this is due to disease or injury. But one point is largely overlooked by those who oppose as unethical the treatment of those patients who wish to have their facial appearance improved by plastic operation, regardless of physiological function.

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The question of medical ethics is basically one of opinion, and this is largely derived from the tenets of the hippocratic oath, to which every student of medicine subscribes on receiving a diploma as a medical school graduate. This oath binds them to "that system or regimen which, according to my ability and judgment, I consider for the benefit of my patients . . ."

Those who are opposed to plastic surgery not clearly indicated by physiology and function also overlook the teaching of psychosomatic medicine, which is that any severe or continued emotional irritation may lead to a physical disorder. What can be more of an emotional irritant than something in a person's facial appearance of which he is continually being made aware by the attitude of those about him, whether in school, as a child, or in his work, where he meets with discrimination—or fancies he does—from his employers and his fellow-workers. Even though the idea is only imagined, the emotional effect still exists, and even if others with similar physical peculiarities are quite unconscious of any disturbance due to them the constitutional organization of the one who does is not altered. Only by removing the source of continual emotional irritation can the physician benefit his patient.*

The justification of cosmetic surgery can also be found by comparing this therapeutic method with others that are familiar practice in other medical departments. The frequent use of the generally accepted placebo is in effect comparable to the cosmetic facial operation, even if function is not involved. Few physicians can say that they have never resorted to its use.

* References 6 and 7.

Further, there are methods employed by the neurologist involving suggestion, both with and without reinforcement by such means as static electricity, such as use of an inert electrode to restore sensation or motion or the administration of such placebos as odorous preparations of valerian or gentian. The cosmetic operation is in fact more ethical, since the patient is actually made more attractive both to himself and to others and thus experiences less emotional discomfort. A study of the effectiveness of a placebo made on 162 patients with various complaints showed that more than half of them reacted favorably to its use.[8]

From another standpoint, an attempt is apparently being made to separate the practice of esthetic surgery of the head and neck from the field of surgery in general, and more particularly from the practice of otorhinolaryngology, a development to which I do not subscribe. However the subject is viewed, it remains surgery still and subject to all the rules of major surgery. As to cosmetic surgery and the otolaryngologist, there could be no one more capable of dealing with this type of surgery than those who have already had not only the special training required but also the experience which supplements such training.

If cosmetic surgery were to be an isolated subject, as has been suggested,[9] it would then stand in a similar relation to medicine, and to general surgery, that surgery did in the days when it was freely done in England by barbers. A somewhat similar cycle would be entered upon now as in the early part of the 12th century and for some time following, when barber surgeons not only did surgery, but also "polling and delousing," as well as being periwig makers. This state of similarity is emphasized by the recent report of an English woman "of limited means," who requested that she might have a face-lifting operation under the National Health Service. The argument was presented that if the physician considered that the patient's welfare would be actually increased by the operation there was no reason why it should not be performed under the Service. The mention was also made in justification of the face-lifting that it was comparable to the Service having supplied about 54,000 wigs during a period of seven years. Though "they were not life-saving needs, they undoubtedly contributed to health and well-being." The reason for the face-lifting was not stated, but there was doubtless an underlying emotional factor.

A case from my practice illustrates the point presented here. A university professor, 57 years of age, who had a conspicuous nose, came with the request that it be reconstructed. He said that his son, who attended his father's classes, had told him that the students had commented on the father's nose and had said that he looked as though he must have been a pugilist.[10] This remark disturbed the professor to such a degree emotionally that he could not tolerate his nose any longer. Although he confessed that his attitude was somewhat silly, later he felt a definite relief at the result of the operation. If one examines this instance carefully, there is a suggestion that a man who has gotten on with a conspicuous feature of 57 years without being conscious of it, and then becomes emotionally disturbed by the students' comments, presents the picture of a change in critical judgment, due to aging. His relief after having had the corrective operation also suggests that a more serious mental disorder may have been averted by this means and that the operation was in accord with the laws of mental hygiene.

That the example just presented is not unusual can be shown by another similar case in my practice. A judge, 49 years of age, was so disturbed by finding a caricature of his profile on a blackboard when he entered a high-school classroom where he was to lecture that he had his nose reconstructed, with resulting relief of his uncomfortable emotional self-consciousness, although he had apparently had no unpleasant awareness of his nose at any time before then.

In contrast to the emotional attitude of these two men was that of a very prominent Congregational minister. On a trip to Europe, he shared a stateroom with another man, who

went to the purser and requested other quarters because he thought the man in his stateroom (the minister) was such a frightful and dangerous-looking person. The minister, who was the one suspected, enjoyed telling this story on himself with great amusement. He was not led to have his face surgically altered.

Cosmetic surgery also has a place that should be recognized wherever the natural facial features seem to interfere with the economic success of the persons. The same is true of those who appear in public, as on the dramatic stage, in moving pictures, and on the television screen. Although in this group the results of plastic surgery would seem to represent a matter only of personal financial benefit, one can easily think of others who have unusually grotesque features but who would apparently not part with them for any consideration, but rather consider them as contributing to their hallmark of fame. Here, again, the difference in individual personality is indicated.

Two physicians in this country have contributed especially by their public expressions as well as by their persistence in carrying on the field of cosmetic surgery regardless of the criticism and antagonistic attitude of many of their colleagues. The one with the greatest number of years of effort to his credit is Fomon, who has not only exerted continued effort in behalf of cosmetic plastic surgery but has also enthusiastically and ably trained younger men to broaden this field. The other capable surgeon to whom reference is made is Lierle, who has enthusiastically endorsed the teaching at the Academy meetings to the otolaryngologists and rhinologists, demonstrating the value of cosmetic surgery in their practice. There can be no doubt but that the ear, nose, and throat specialist has the most valuable training and experience for the practice of this type of surgery.

When I was in Europe in 1937, it was evident that cosmetic surgery was then recognized there much more widely as an ethical procedure, and as a justifiable branch of general surgery, than it was at the same time in this country. Here, at that time, it was largely regarded as a form of operating to be done more or less secretly and was considered by many surgeons as only to be done by charlatans; any surgeon performing such an operation must necessarily himself be one.

This attitude still persists among some physicians who have not yet reached the point of considering that the methods of cosmetic surgery are entirely ethical and are a valuable addition to the field of surgery in general. It is somewhat to the point to quote from the writing of Whitehead, the eminent psychologist, that "It requires a very unusual mind to undertake the analysis of the obvious." As in all newer undertakings, the recognition of cosmetic plastic operations as a part of the practice of the ear, nose, and throat specialist will be gained more surely and rapidly if its protagonists unite to continue upholding it, both by words and by their professional practice.

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REFERENCES

1. Seltzer, A. P.: History of Plastic Surgery, Laryngoscope **51**:256 (March) 1941.

2. Seltzer, A. P.: Recent Advances in Plastic Surgery of the Nose, Eye, Ear, Nose & Throat Month. **30**:544 (Oct.) 1951.

3. Seltzer, A. P.: A Case of Receding Chin and Hump Nose with Corrective Method, Laryngoscope **61**:1030 (Oct.) 1951.

4. Seltzer, A. P.: Plastic Surgery of the Prominent Auricle, A. M. A. Arch. Otolaryng. **60**:316 (Sept.) 1954.

5. Seltzer, A. P.: Plastic Repair of Hereditary and Development Anomalies, Arch. Pediat. **62**:249 (June) 1945.

6. Seltzer, A. P.: Esthetic Surgery as an Emotional Restorative, Am. Pract. & Digest Treat. **5**:191 (March) 1954.

7. Seltzer, A. P.: The Nose as a Factor in Neuroses, Philadelphia Med. **45**:23 (Aug. 13) 1949.

8. Lasegna, L.: Placebos, Sc. American **193**:68 (Aug.) 1955.

9. De Kleine, E. H.: The Crossroads of Cosmetic Surgery, Plast. & Reconstruct. Surg. **16**:145 (Aug.) 1945.

10. State May Pay for Face Lifting, Foreign Letters (England), J. A. M. A. **159**:965 (Oct. 29) 1955.

11. Graham, H. (pseud. of Flack, I. H.): The Story of Surgery, New York, Doubleday, Doran & Company, Inc., 1939.

12. Seltzer, A. P.: Surgery of the Pugilist Nose, Ann. Otol. Rhin. & Laryng. **59**:924 (Dec.) 1950.

Status of the Stapes in Chronic Middle-Ear Suppuration

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Of the patients in whom operative construction of the middle ear (tympanoplasty) was carried out with the objective of eradication of infection and restoration of hearing during 1954, the findings were recorded in detail in 125 cases of chronic otitis media and 22 cases of postradical mastoidectomy.

The results of examination of the state of the stapes in these cases are presented here.

The state of the stapes is not only closely related to the restoration of hearing, but treatment of this part is also an extremely important problem from the standpoint of elimination of inflammation and restoration of hearing.

Mobility of the stapes also determines the necessity or unnecessity for fenestration, and the presence or absence of the stapes is important from the standpoint of method of treatment. The basis for operative procedures in chronic otitis media to eradicate inflammation, prior to determination of whether to carry out secondary tympanoplasty, is the necessity of clarifying the possible alterations in the state of the stapes. The investigations were carried out with the above objectives.

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RESULTS

Table 1 shows the state, presence, and mobility of the stapes in the cases of chronic otitis media and postmastoidectomy (radical) cases examined.

In cases where the stapes was present, the mobility was good in some, there was ankylosis in others, and mobility was partially disturbed in still others. On the other hand, the stapes was absent in some cases and accidentally removed in others. The mobility, absence, and removal of the stapes are an important problem, so these points were investigated further.

MOBILITY OF THE STAPES

The mobility of the stapes was examined with a probe during operative procedures in chronic otitis media in 113 cases. The stapes was freely movable in 82%; mobility was poor in 20 cases, and of these there was complete fixation in about 10%. These figures coincide with results reported in the previous study in 99 cases where there was free mobility in 84%, poor mobility in 16 cases, with ankylosis in 8%. A large number of the cases reported previously, however, are also included in this study. Table 2 shows

TABLE 1.—*Status of the Stapes (1954)*

Disease	Stapes				
	Mobility Free	Ankylosis	Mobility Poor	Absent	Extracted
Chronic otitis media	87 (82%)	11 (10%)	9	12	6
After radical mastoidectomy	8	4	4	5	1

TABLE 2.—*Status of the Stapes (1955)*

Stapes	Mobility Free	Ankylosis	Mobility Poor	Absent	Extracted
Cases....	29	2	2	5	0

the findings on the mobility of the stapes in the recent cases.

The results in the recent cases would therefore be 76% freely movable, four cases having poor mobility, with ankylosis in 5%. There is therefore little difference in the figures compared with the previous study.[3] It is suggested from these findings that the mobility of the stapes is poor in 8%-18% of the cases of chronic middle-ear suppuration, and fenestration operation is indicated in 5%-10%.

The mobility of the stapes was also examined in 17 cases in which ear discharge persisted even after radical mastoidectomy. Mobility was good in nine (53%) and poor in eight, with ankylosis being found in four (23%). These figures coincide with those in the previous study.

It can therefore be said that the possibility of disturbance of mobility occurring during the process of recovery after surgery exists. This also means that cases requiring fenestration as a therapeutic measure for restoration of hearing following radical mastoidectomy are not few, and shows the appropriateness of the method of tympanoplasty at the time of radical mastoidectomy advocated by the author. The disadvantage of secondary tympanoplasty is clearly demonstrated.

LESIONS OF THE STAPES

Pathological changes, as loss of the stapes, loss of its head, loss of its crura, carious or other changes, in a part are observed, besides alterations in mobility of the stapes. The designation "stapes absent" in Table 1 designates cases in which there was loss of both the head and the crura of the stapes. It is my plan to conduct more detailed studies on the effect of loss of the head alone, one crus alone, and caries of these parts or the footplate of the stapes, and the results will be presented in a later paper. The loss of the stapes will be discussed in this study under the above interpretation.

With the above meaning, 12 cases in which the stapes was absent were observed in 125 cases of chronic otitis media. Examination of the outer two ossicles in these 12 cases showed that both the incus and the malleus were absent in half, that is, 6 cases; a severe carious state of both the incus and malleus was found in 4, and the incus was absent and the malleus carious or the incus carious and the malleus normal in 1 case each.

Thus in the cases where the changes were sufficiently severe so that there was loss of the stapes, the incus was intact in none and in almost all the cases there were severe pathological changes in both the incus and the malleus. This shows that when the pathological changes are sufficiently severe to eliminate the stapes, the other outer ossicles are affected to a degree where the normal structure is almost totally destroyed.

A simple method for observing the changes in the stapes prior to or during surgery is important clinically. The reason for this is that severe change in the stapes is an important problem in the restoration operation for hearing. It is also very difficult to view the stapes wholly in the natural state before or during operation. To be able to see the stapes in situ during surgery requires great skill. With the object of finding some simple standard which could be utilized, the following investigations were carried out.

Examination of the tympanic cavity in cases in which the stapes was absent revealed the pathological changes shown in Table 3. The stapes were lost due to formation of cholesteatoma in half the cases. It can therefore be assumed that the stapes would be lost in the greater percentage of cases with cholesteatoma formation.

TABLE 3.—*Pathological Changes in the Tympanic Cavity in Cases with No Stapes*

Condition	Cholesteatoma	Granulation	Epidermization
Cases.....	6	4	2

TABLE 4.—*Status of the Stapes in Otitis Media Cholesteatomatica*

Stapes	Absent	Freely Movable	Poor Mobility	Total
Cases.....	6	19	2	27

Table 4 shows the state of the stapes in 27 cases in which cholesteatoma was found by operation. The stapes was absent in 22% of the otitis media cholesteatomatic cases, while in the majority of the others the stapes was present. Examination of the spread of the cholesteatoma in cases with no stapes showed that in five of the six cases the cholesteatoma reached to the mesotympanum. In the cases in which the stapes was present, the cholesteatoma spread from the epitympanum to the mastoid antrum only in 18 of the 19 cases, and there was merely a thickening of the mucous membrane or granulation present in the mesotympanum. The loss of the stapes due to formation of cholesteatoma therefore occurs only when the cholesteatoma progresses to the point where it fills the tympanic cavity.

As can be seen in Table 3, however, cases were not few in which there was loss of the stapes even though there was no cholesteatoma but only granulation in the tympanic cavity. When caries of the head and crura is taken into consideration, it can be said that changes in the stapes occur in chronic middle-ear suppuration even without cholesteatoma formation.

It can therefore be assumed in otitis media cholesteatomatica that when there is widespread growth of the cholesteatoma there will be loss of the stapes. In other cases, however, it would be impossible to anticipate loss of the stapes prior to or during surgery on the basis of pathological changes in the tympanic cavity.

An investigation was then conducted to see whether it would be possible to anticipate loss of the stapes from changes in the other two ossicles.

If it were possible to know the changes in the stapes from changes in the incus and malleus, it would be very advantageous. The results are shown in Table 5.

From these results it can be said that when the incus is absent or there is a severe pathological change present, the stapes will be lost. This is especially true when both the incus and the malleus are severely affected. Therefore, when it is observed that the incus is absent at surgery, there is a great possibility that the stapes will show a marked pathologic change and this possibility becomes even greater when the malleus is also absent. On the other hand, when the incus is intact, it can be assumed that there will be no severe pathological change in the stapes. Determination of the absence of pathological change in the incus is actually impossible without making it also possible to visualize the state of the stapes, but it is possible to presume the state of the stapes by picturing the condition of the incus by viewing a portion of the long crus of the incus. From the above two points it is possible to deduce the absence of the stapes before or during operation.

The status of the stapes was next examined in the 22 cases in which radical mastoidectomy had already been performed, and the results are shown in Table 1. As can be seen, the stapes was absent in 5 (23%) of the 22 cases. This coincides with the frequency of absence of the stapes in the cases of otitis media cholesteatomatica shown in Table 4. If the radical mastoidectomy had been performed for the otitis media cholesteatomatica, this frequency of absence of the stapes could be understood, but the indications for radical mastoidectomy include others besides otitis media cholesteatomatica. The problem then would be the frequency of otitis media cholesteatomatica among the cases in which radical mastoidectomy had

TABLE 5.—*Status of the Stapes and of the Malleus and Incus*

Malleus, Incus	Stapes		
	Absent	Freely Movable	Poor Mobility
Both absent	7	6	1
Both with severe pathologic changes	3	13	5
Incus absent	8	13	5
Incus normal	5 (only head lost)	44	7

TABLE 6.—*Frequency of Radical Mastoidectomy*

Year	Condition	
	Cholesteatoma	Others
1951.....	13	18
1952.....	16	25

been carried out. There are very few reports regarding this point and the indications for surgery differ among the various workers, so the frequency with which this condition was encountered in this department was examined. Table 6 shows the results of this investigation.

When one views this frequency of radical mastoidectomy more broadly, it can be seen that about half of the cases are otitis media cholesteatomatica, and, though the indications vary according to the worker, otitis media cholesteatomatica cannot be regarded lightly as an indication for radical mastoidectomy.

Let us consider more closely the 23% in which the stapes was absent in the cases in which radical mastoidectomy was already performed. Three causes are suggested as to the loss of the stapes: (1) the stapes was already lost prior to the operation; (2) the stapes was lost during the operation or during the postoperative treatment, and (3) it was lost by residual inflammation after the operation. In order to discuss the absence of the stapes in the 23% it becomes necessary to investigate the state of the stapes in cases which are considered indications for radical mastoidectomy. Table 7 shows the cases selected from those in this series.

From these results it can be assumed that the stapes is already absent in 10% of the cases in which radical mastoidectomy is indicated prior to the operation and it can be seen from Table 6 that the frequency of otitis media cholesteatomatica is higher in those cases in which surgery was actually carried out. Under the assumption that otitis media cholesteatomatica is found in half of the cases in which radical mastoidectomy is indicated, the percentage of cases in which the stapes is absent prior to surgery becomes 13%. From this, it can be said that the stapes was lost at the time of surgery or the loss was due to residual inflammation in the remaining 10% of the 23% in which the stapes was absent after radical mastoidectomy.

TABLE 7.—*The Status of the Stapes in Cases in Which Radical Mastoidectomy is Indicated*

Otitis Media	State of Stapes				
	Freely Movable	Poor Mobility	Absent		Total
Cholesteatoma..	19	2	6	10%	27
Purulent.....	35 (2)	12	2		51

On the other hand, it can be assumed from Table 7 that there is a possibility of the stapes being lost because of the presence of residual inflammation following surgery in 4%. The remaining 6% must therefore be regarded as those in which the stapes was lost prior to or during previous surgery and its after-treatment. This value is the result of placing the emphasis on otitis media cholesteatomatica as the indication for surgery, so when the figures shown in Table 7 are taken without alteration as indications for radical mastoidectomy, the percentage of cases in which the stapes was lost during previous radical mastoidectomy or in the postoperative therapy becomes 10%. It can therefore be said that the possibility of loss of the stapes is 6%-10% in radical mastoidectomy. This value coincides with the possibility of 5% of extracting the stapes during not meticulous operation given in Table 1.

EXTRACTION OF THE STAPES

It was found that there is a possibility of removing the stapes in 6%-10% of the cases during the process of radical mastoidectomy. With the method used up to the present time, however, extreme care is taken not to touch the stapedial region during radical mastoidectomy. How then is the stapes extracted during the operation? Three causes may be given, that is, (1) the stapes may drop out in the process of removing the incus; (2) the stapes may be removed in the process of removing the lesions in the epi-

tympanum, and (3) it may be removed in the process of debriding and clearing out the tympanic cavity. Due caution, however, has not been paid in regard to removal of the stapes in the surgical procedures heretofore, and, though it is said that care must be taken not to remove the stapes, there are few reports as to how this can be avoided. In 1954 the stapes was accidentally removed in 5% of the cases in which tympanoplasty was performed by me and my staff. Studies were therefore conducted as to how these accidents occurred despite the painstaking care taken. It was found that these were cases in which the less experienced members of the staff had performed the operation. It is unnecessary to make such an apologetic statement, but it is feared that the former statement would be interpreted to mean that the stapes will be inevitably lost in 5% of the cases, and this is not entirely true. A study of the dates when the stapes was accidentally removed in 1954 showed that this was limited to two months, February and June, and these coincided with the time when there was a turnover in the personnel and relatively inexperienced members of the staff were in the operating room. This has been verified by the fact that not one case has been experienced in 1955 (Table 2).

The problem, then, is how these staff members can be trained to avoid removing the stapes. The method which I use at present is given below.

When it is necessary to remove the incus though the incudostapedial joint is normal, the following method is used. The incudostapedial joint is disjointed with a pincette, the corpus of the incus grasped with forceps, the corpus drawn lateroposteroward, and at the same time the long crus is pushed medioanteroward. The incus can be removed in this manner without disturbing or harming the stapes. In removing lesions in the stapedial region, the pathological tissue is usually drawn medioanteroward and removed, but when there is a high degree of connective-tissue proliferation, the stapes should be fixed with forceps and the lesion cleaned out. When hard connective tissue or bony connective tissue is present, the cleaning process should proceed by cutting away with a pair of scissors. With the procedures described, the accidental removal of the stapes can be entirely prevented. It is necessary, of course, that these procedures be carried out under a clear field of vision, with use of a magnifying lupe and continuous irrigation and suction.

COMMENT

In reporting on the state of the stapes, detailed studies have been presented in regard to otosclerosis, but there are few reports in regard to chronic otitis media. Surgical treatment of chronic otitis media has consisted of radical mastoidectomy and conservative radical mastoidectomy. In the case of the conservative operation, it is performed under the assumption that the stapes is intact, and in the radical operation the stapedial region is left alone as much as possible. It is only natural, therefore, that reports on the changes in the stapes in chronic otitis media are few. When there is a reappearance of ear discharge or no cessation of discharge following operative treatment of chronic middle-ear suppuration, the pus drains out in most of the cases from the two labyrinthine window regions or the Eustachian orifice. This means that the removal of the lesion in the stapedial region has been inadequate in a large number of cases and is the natural result of surgery by the postauricular route. With the surgical technique heretofore it was difficult and unnecessary to observe the state of the stapes, and so there was no will to do so. The problem of the lesions in the stapes has become important clinically with advances in the fenestration operation for otosclerosis, and the problem of the state of the stapes in chronic otitis media has become important with development in operations for improving hearing. Operative methods both for eradication of inflammation and for restoration of hearing in chronic otitis media are recently developing problems. The majority of the reports,

therefore, deal with operative techniques. I,[1] too, have dealt chiefly on the methods up to now, but in this paper the status of the stapes observed during operation is presented. Poor mobility of the stapes in chronic otitis media is a secondary inflammatory change and is an entirely different entity from the ankylosis occurring in otosclerosis. Almost all of the reports up to now have been concerned with ankylosis of the stapes in otosclerosis. In chronic otitis media, however, there is not only ankylosis but also caries, absence, and various other conditions of the stapes. As the state of the stapes was considered extremely important in tympanoplasty, investigations were conducted.

SUMMARY AND CONCLUSION

In chronic otitis media, the stapes shows various pathological changes, but these are severest in cases with cholesteatoma formation.

In cases where it is necessary to remove the incus and the incudostapedial joint is intact, the procedure must be carried out with extreme care. The procedure is described.

REFERENCES

1. Goto, S.: Enhanced Hearing Radical Mastoidectomy: Second Report, Nagoya J. M. Sc. **17**: 143-145 (June) 1954.

2. Goto, S.: Mobility of the Stapes in Chronic Otitis Media, Otolaryngology (Tokyo) **27**:303-306 (June) 1955 (in Japanese).

Anatomical Factors in Stapes-Mobilization Operations

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To Rosen * goes the credit for revival of a surgical procedure for mobilization of the stapes in patients with ankylosis due to otosclerosis. A similar procedure was practiced in Europe for some time toward the end of the last century by a few otolaryngologists and was abandoned later for reasons which are not entirely clear in the literature.† Apparently there were those who felt the procedure dangerous in preantibiotic days.

Considerable interest arose after Rosen's first publication, and variable reactions were soon heard. In the autumn of 1954, Dr. Franz Altmann, of our department, received a personal letter from Prof. F. Zöllner, of Germany, with an enclosed photograph of an evulsed stapes (Fig. 1). In a discussion at the session of the German Otological Society [5] held in June, 1954, in Dusseldorf, Germany, Professor Zöllner had reported the history of this stapes. It was removed from a patient who was about to be fenestrated for otosclerosis. While he was checking the mobility of the stapes, it broke and was eventually removed, leaving part of the "posterior crus and two-thirds of the footplate" behind. No perilymph was seen escaping from the oval window. The patient's hearing after fenestration was good. It was Professor Zöllner's feeling that the mobilizing movements in Rosen's procedure could break the stapes in a similar way and that the energy of sound waves could then again be transmitted from the drum through the ossicular chain to the broken mobile part of the stapes footplate. This could restore the hearing to normal.

Fig. 1.—Photograph of the broken stapes of Professor Zöllner's patient. "Lower part of the posterior crus and two posterior thirds of the footplate" are missing (explanation in text).

It was decided to make a laboratory study of stapes mobilization with the following ideas in mind: 1. What are the mechanics of Rosen's procedure? 2. Is there a better way to restore the mobility of a fixed stapes in otosclerosis?

METHOD

Most of the investigative work with which this paper deals was done on temporal bone removed from fresh autopsy material. If they

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* References 1 and 2.

† References 3 and 4. Moure, E., in discussion on Miot,[4] p. 225.

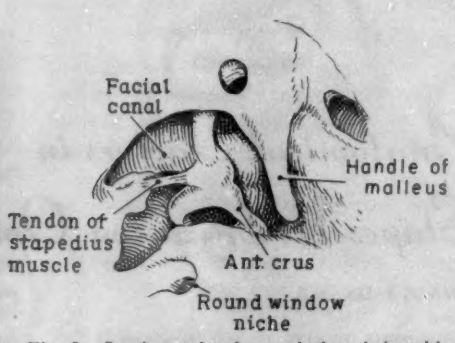


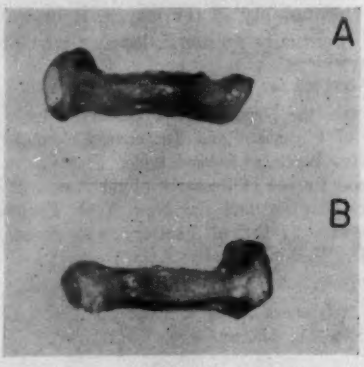
Fig. 2.—Specimen showing ossicular chain with stapes in oval window. Bony part of external acoustic meatus and the drum removed (right side).

were stored at all, it was in isotonic saline solution in a refrigerator. The observations from over 100 temporal bones are described.

The mechanics of the ossicular chain were first studied on these fresh specimens, particular attention being paid to the movements of the stapes. As a rule, for better vision, the bony part of the external canal and the drum were removed and the ossicles exposed (Fig. 2). When the handle of the malleus was gently pushed inward, it was found (and recorded by slow-motion camera) that the stapes movements consist of inward tiltings of the anterior part of the footplate. Similar movements of the stapes are described by Stevens and Davis in their book on physiology of hearing,[6] summarizing the experiments of Krainz,[7] Dahmann,[8] and Békésy.[9] They state that the explanation for this type of movement is that the "annular ligament of the stapes is thick and tight at the lower posterior pole and is broad and thin at the upper anterior pole." One wonders if this is the only reason for the tilting movements. It seems more probable to us that the explanation for these movements lies in the bony and cartilaginous structures of the stapes, especially its head and base. The neck of the stapes is not exactly in the axis of the crura. It bends upward toward the facial canal. Bast and Anson [10] describe the head of the stapes as "being usually tilted superiorly and anteriorly." According to our observations, the round cartilaginous part of the head, the fovea, is attached to the neck so as to always create an angle which slants posteriorly and downward (Fig. 3). The lenticular process of the incus slides on this inclined plane during ossicular-chain movements. The posterior slanting of the fovea causes the inward movements of the anterior part of the footplate; the downward slanting causes the inward tilting of the anterosuperior part with pressure inward on the handle of the malleus (Fig. 4). The heel-like posterior part of the footplate, the thin anterior part, and the slanting fovea seem designed to make these movements possible.

The fulcrum of the normal footplate lies near the base of the posterior crus. The posterior part of the footplate is thicker than the anterior part, and the circumferential lip of the footplate is also much higher posteri-

Fig. 3.—Photographs of right stapes: *A*, the view from behind; *B*, view from the front. Fovea of the head slants down and posteriorly.



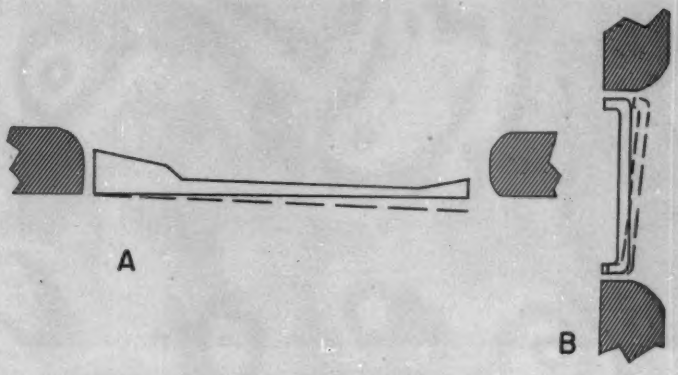


Fig. 4. — Schematic drawing of the stapes footplate: *A*, profile of the footplate showing the inward tilt of the anterior end. *B*, vertical cross section showing the inward tilt of the anterosuperior portion of the footplate.

Fig. 5.—Horizontal section through the temporal bone. Note the markedly larger posterior part of the footplate forming sort of a "heel" (*H*).

orly, joining the base of the posterior crus as sort of a "heel" (Fig. 5). This heel fits snugly into the posterior part of the bony frame from the oval window, which, to accommodate it, is much higher here than anteriorly. The posterior part of the frame of the oval window runs perpendicularly into the vestibule, whereas the anterior and anterosuperior part of it slopes forward.

It was necessary to devise an "artificial" otosclerosis for our study. After several trials we succeeded in fixing the anterior portion of the stapes to the surrounding bone by using Wood's metal (Fig. 6). A considerable amount of metal is necessary to do this, and Rosen's procedure alone fails to free a stapes fixed in this manner without shattering it. We, therefore, fixed several isolated fresh stapes to a metal bar, using the same metal in different amounts, and were thus able in an easily studied and photographed preparation to simulate "minimal," "moderate," and "massive" ankylosis (Fig. 7). The classical Rosen procedure, as it is known from his publication, was said to free the stapes by applying pressure backward against

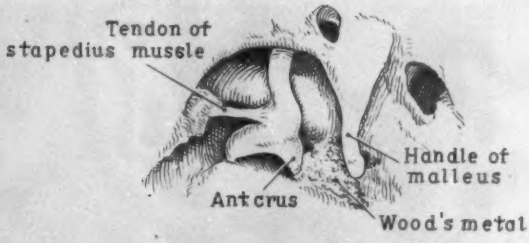


Fig. 6.—"Artificial otosclerosis" (same specimen as in Fig. 2). Anterior part of stapes fixed with Wood's metal. The bone surrounding the round window was removed and round-window membrane so exposed. Membrane painted black with India ink.

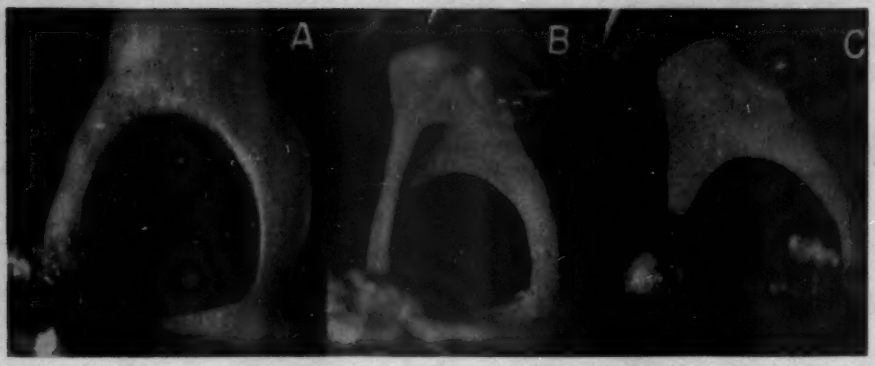


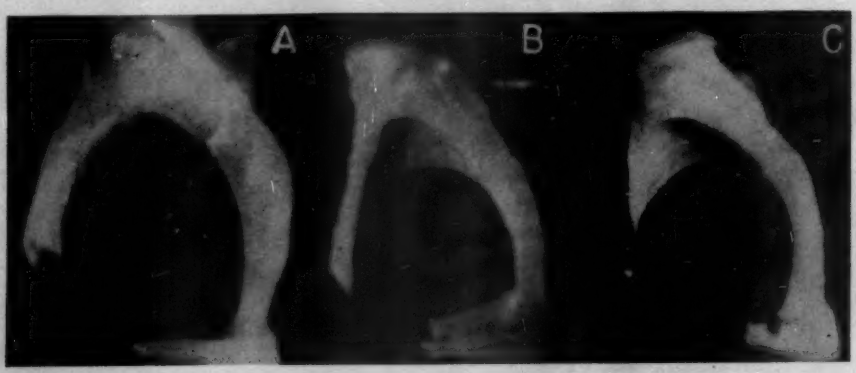
Fig. 7.—Three isolated stapes fixed to a metal bar with different amounts of Wood's metal simulating minimal (*A*), moderate (*B*), and massive (*C*) ankylosis.

the stapes neck. The question was what actually happened in "successful" cases where the hearing was improved by this maneuver.

Rosen's procedure was therefore applied to several isolated fresh stapides fixed anteriorly and the whole action filmed with slow-motion cinematography. When slight, or moderate, pressure only was applied, the stapes was not freed from its fixation but another interesting observation was made. While pushing posteriorly against the neck of the isolated and anteriorly fixed stapes, one can clearly see the elasticity of the crura. Under moderate pressure there is a variable deformation of the crural arch and bending of the footplate, which returns to its original position after the force is removed. When a greater force was used, in all specimens the anterior crus broke close to its base and the footplate close to the anterior fixed portion (Fig. 8). This is very probably what happens in the successful cases of Rosen and of those who follow his technique. Professor Zöllner's stapes picture is quite similar (Fig. 1), except that he reported the posterior crus as broken rather than the anterior crus.

It is possible that in certain early cases of otosclerosis, where part of the otosclerotic focus is in the form of a tiny bony bridge between the promontory and the anterior tip of the footplate (Fig. 9), this could be broken by some maneuvers and the footplate thus mobilized. It is, however, hard for us to believe that one could do it by pushing strictly backward against the neck of the

Fig. 8.—Same stapes as in Figure 7. Picture shows the way metal bar was broken off during Rosen's procedure.



stapes. This is a direction in which, according to our experiments, the stapes can be moved practically not at all.

It seems that the logical maneuver for mobilizing the stapes, even one which is only slightly fixed, would be to apply pressure from behind forward and from below upward and vice versa. These directions follow the normal movements of the stapes. It is true that one can see the movements, or shortening of the tendon of the stapedius muscle, during the Rosen stapes mobilization procedure, but these may represent the elasticity of the crura as they bend under pressure. Such bending of the crura can only be accurately assessed with a magnification of × 10 or more.

In a further investigation of the elasticity of the crura and the footplate of the stapes other specimens were prepared as described above and shown in Figure 2. The bone surrounding the round window was removed with a curette, thus exposing the round-window membrane for direct observation. In addition, an ink spot was placed at the round-window membrane to facilitate observations of the movements, and the whole procedure was again recorded by slow-motion cinematography. When pressure was applied to the handle of the malleus, it brought the whole ossicular chain into motion and clear, distinct movements of the round-window membrane could be observed. When the stapes was fixed with Wood's metal and pressure was applied against the handle of the malleus, movements of the ossicular chain could again be observed but there were no movements of the round-window membrane. On the other hand, when force was applied from behind directly against the stapes neck, slight but distinct motion of the round-window membrane could be observed. These motions must have been due to elasticity in the footplate, for in each of these specimens when the experiment was repeated and pressure was applied against the handle of the malleus there were again no movements of the round-window membrane, indicating that the fixation of the anterior part of the footplate was still present. Direct force of the surgeon's hand can apparently compress and partially displace the elastic footplate of the stapes even if it is fixed—with metal fixation of a specimen or with an otosclerotic focus in a patient—without actually breaking the ankylosis. The much smaller energy of ordinary sound waves transmitted through the ossicular chains to the footplate can not conceivably do so. This may explain some failures where, on attempted mobilization, distinct movements of the stapes were observed, or felt, without improvement in the patient's hearing.

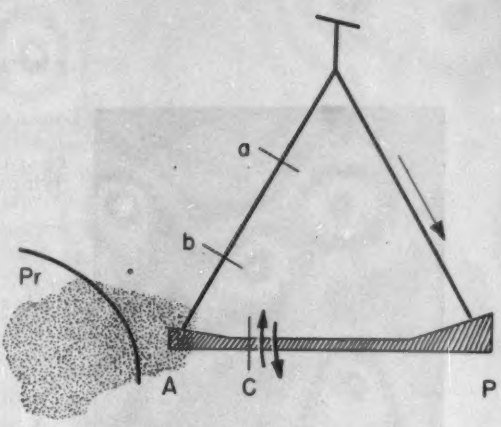
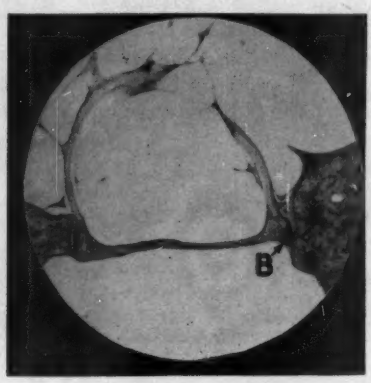
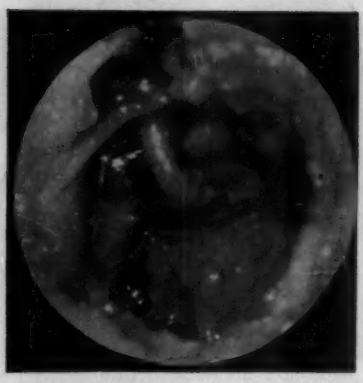


Fig. 10.—Schematic drawing representing the ankylosed stapes in a case of otosclerosis. To overcome the otosclerotic focus and reestablish stapes mobility the anterior crus should be cut between *a* and *b* and the footplate broken at *C*. Movements thus restored follow the directions pointed out by arrows.

Fig. 9.—Microphotograph, horizontal section, of a right otosclerotic temporal bone. *B* points to a tiny bone bridge fixing the footplate to the promontory.





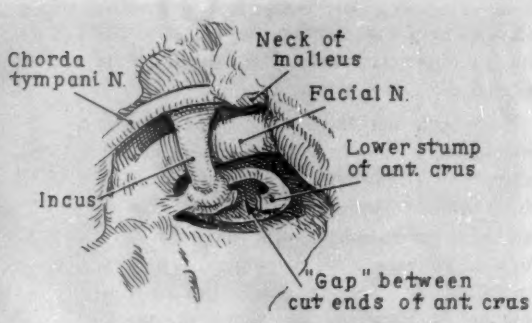


Fig. 11.—Part of anterior crus cut out and a "gap" created.

Our reasoning for establishing what we think is a logical method for mobilization of the ankylosed stapes went along these lines:

In a large majority of cases with otosclerosis the otosclerotic focus fixes only the anterior part of the stapes and hinders and eventually stops its movements. To relieve this obstruction and restore free motions one has to free two arms of a corner of the triangle, leading to this fixation (Fig. 10). This should occur if the anterior crus is cut and the anterior end of the footplate is broken behind the otosclerotic focus as well. For cutting the crus we adopted McLane's scissors, which were described elsewhere.[11] To prevent a reunion of the cut crus, as a rule we make two cuts, one near the neck of the stapes and the second one as close to the footplate as possible, and remove the small cut-out part by suction. A considerable "gap" is so created (Fig. 11). It is advantageous to make the first cut high, close to the neck of the stapes, because after the first cut is made the stapes becomes very mobile and the second cut can more easily break and dislocate the posterior crus. This sometimes happens when the first cut is being made because the shearing action of the scissors may give the whole stapes a jerk, which breaks the posterior crus. This often seems to do no harm, perhaps because the crus is enveloped by a thick layer of mucosa, which may, along with the stapedius tendon, prevent its dislocation. A fractured crus without dislocation may heal again. On the other hand, a jerking movement of the stapes can fracture the footplate at the time that the anterior crus is being cut. In such a case the patient usually volunteers that there has been a sudden improvement in hearing. Postoperatively these cases seem to have the very best hearing.

If there is no improvement in hearing after the maneuver of cutting the anterior

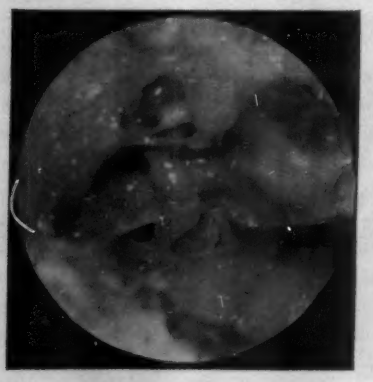


Fig. 12.—Needle everting the lower stump of the anterior crus forward. Footplate breaks at about the anterior third.

crus, the next step is to deliberately fracture the fixed footplate in some way. It was found, while working on normal specimens, that the footplate could be broken in the following manner. After anterior crurotomy a straight needle could be put behind the lower stump of the anterior crus and by pushing forward the anterior third of the footplate could be broken and partially evulsed forward without dislocating it from the oval window's frame (Fig. 12). This, of course, takes place in normal specimens, where the footplate is not ankylosed, and one can object that it is not, as a rule, possible in a patient with otosclerosis, where this part of the footplate is firmly fixed. If, however, the ankylosis is not too great, one can postulate that this maneuver might work.

On the basis of our present knowledge of otosclerotic ankyloses, it would seem more logical to fracture the stapes footplate by maneuvers designed to make the break behind the otosclerotic focus. This can apparently be achieved by a variety of methods, as the fracture often occurs with maneuvers about the head of the stapes (compare Rosen,‡ Goodhill,[12] House,[13] and Kos [14]). As mentioned above, it may occur at the time of anterior crurotomy. If it does not take place with these simple procedures, some operators try to break the footplate with amalgam hammers (compare Goodhill [15] and House §). We have had success with direct pressure with the use of a blunt No. 22 needle, which is used for suction, or even a fairly sharp, slightly curved needle (under microscopic control) and also with the pneumatic hammer of House. The search for the best of these procedures is still going on.

All these above-described procedures represent a good deal of instrumentation around the stapes in the middle-ear cavity. It is therefore important to draw one's attention to the anatomical relationship between the stapes and facial nerve. In the majority of cases the canal of the facial nerve, as it runs diagonally through the middle ear, is above and far enough from the crura of the stapes not to be in any particular danger of injury during stapes mobilization. In some cases, however, this distance is quite small and the facial canal and the crura practically touch each other (Fig. 13). This part of the facial canal is also paper thin. It is obvious that the slightest slip of an instrument, be it a Rosen mobilizer or scissors for anterior crurotomy, can damage the facial nerve.

When the footplate has been broken and the anterior crus previously cut, one can see in a specimen how the energy of the sound waves from the drum can be transmitted through the malleus, incus, and the posterior crus to the posterior part of the footplate.

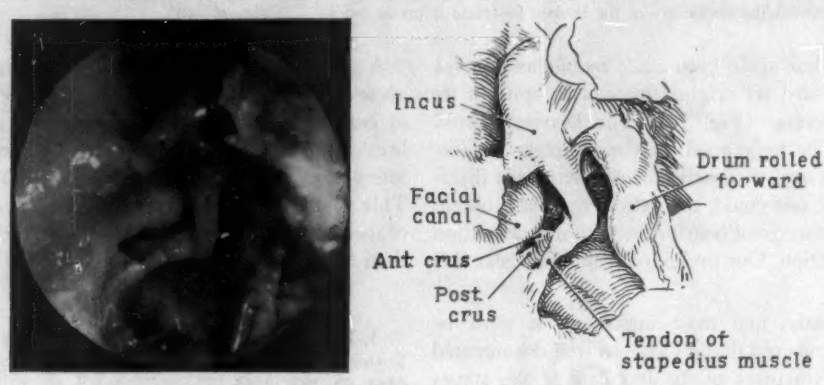


Fig. 13.—View at the ossicular chain in the right middle-ear cavity (as in radical mastoidectomy). Anterior crus of the stapes in contact with the facial nerve canal.

‡ References 1 and 2.

§ House, H.: Personal communication to the authors.

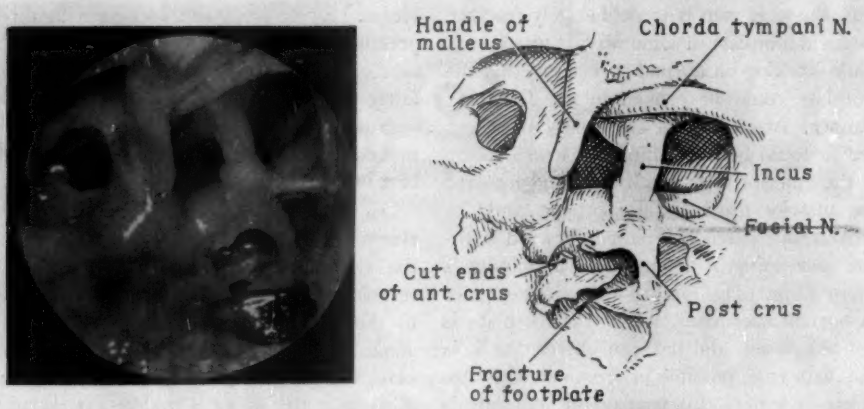


Fig. 14.—Left middle ear: Anterior crus cut and the footplate broken. The bone between the round and oval windows removed, exposing the profile of the broken footplate. (In the patient the continuity of the broken footplate is preserved.)

This has again been made mobile and moves in almost its original manner in spite of its shortening (Fig. 14). The hearing should then be very good. If the footplate is fractured and the posterior crus has been dislocated, one could, theoretically at least, obtain about as good hearing as with a fenestration operation. Our preliminary findings bear this out.[16]

Lastly, and most important, it must be remembered that it has been well documented that fractures of the footplate of the stapes heal by fibrous rather than by bony union (Altmann[17] and Hallpike[18]). There is therefore a good chance that a hearing gain, when once achieved, will be sustained unless the otosclerotic process should advance beyond the fracture line.

SUMMARY

Mechanism of the motions of the normal and fixed stapes was studied on over 100 temporal bones removed from fresh cadavers, and actions in many were filmed by slow-motion cinematography.

The elasticity of the crura and the footplate of the stapes is described.

The underlying mechanism of the Rosen procedure was studied on specimens, and an attempt is made to explain the successful cases achieved by using this maneuver.

A logical solution for freeing the fixed stapes in otosclerosis was sought. This seems to consist of cutting the anterior crus and breaking the fixed footplate behind the otosclerotic focus, thus achieving stapes mobility. This might be permanent due to the tendency of footplate fractures to heal by fibrous rather than by bony union.

REFERENCES

1. Rosen, S.: Mobilization of the Stapes to Restore Hearing in Otosclerosis, New York J. Med. **53**:2650, 1953.

2. Rosen, S.: Mobilization of the Stapes, Acta oto-laryng. **44**:78, 1954.

3. Boucheron, A.: La Mobilisation de l'étrier, Bull. méd., Paris **2**:1225, 1888.

4. Miot, C.: De La Mobilisation de l'étrier, Rev. laryng. **10**:49, 83, 113, 145, and 200, 1890.

5. Zöllner, F., in discussion on Schubert, K.: Zur Indikationsstellung bei der Fensterungsoperation, Arch. Ohren- Nasen- u. Kehlkopfh. **165**:393, 1954.

6. Stevens, S. S., and Davis, H.: Hearing: Its Psychology and Physiology, New York, John Wiley & Sons, Inc., 1938.

7. Krainz, W.: Das Knochenleitungsproblem: Experimentelle Ergebnisse, Ztschr. Hals- Nasen- u. Ohren. **15**:306, 1926.

8. Dahmann, H.: Zur Physiologie des Hörens: Experimentelle Untersuchungen über die Mechanik der Gehörknöchelchenkette, sowie über deren Verhalten auf Ton und Luftdruck, Ztschr. Hals- Nasen- u. Ohrenh. **24**:462, 1929.

9. Békésy, G. v.: Zur Physik des Mittelohres und über das Hören bei Fehlerhaften Trommelfell, Akust. Ztschr. **1**:13, 1936.

10. Bast, T. H., and Anson, B. J.: The Temporal Bone and the Ear, Springfield, Ill., Charles C Thomas, Publisher, 1949.

11. Fowler, E. P., Jr.: Anterior Crurotomy, Acta oto-laryng., to be published.

12. Goodhill, V.: Stapedial Footplate Lysis, Tr. Am. Laryng. Rhin. & Otol. Soc., to be published.

13. House, H.: Discussion, Tr. Am. Laryng. Rhin. & Otol. Soc., to be published.

14. Kos, C. M.: Transtympanic Mobilization of Stapes for Impaired Hearing Due to Otosclerosis, Ann. Otol. Rhin. & Laryng. **64**:995, 1955.

15. Goodhill, V.: Trans-Incudal Stapedolysis for Stapes Mobilization in Otosclerotic Deafness (Under Audiometric Control): A Surgical Technique for Improvement of Hearing in Otosclerosis Is Described, Utilizing New Methods in the Stapes Approach, Laryngoscope **65**:693, 1955.

16. Fowler, E. P., Jr.: Symposium on Mobilization, Tr. Am. Laryng. Rhin. & Otol. Soc., to be published.

17. Altmann, F., and Waltner, J. G.: Slight Operative Injuries of the Stapes, Arch. Otolaryng. **42**:42, 1945.

18. Hallpike, C. S.: On a Case of Deaf-Mutism of Traumatic Origin, J. Laryng. & Otol. **52**:661, 1937.

The Treatment of Acute Asphyxia by the Otolaryngologist

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The otolaryngologist is frequently called on to relieve patients suffering from acute asphyxia caused by obstructive and paralytic lesions of the respiratory tract, severe accumulations of tracheobronchial secretions, central nervous system injuries and diseases, and other pathological conditions which affect the body. He must be ready to respond quickly, at any hour, and to give immediate and lifesaving care for whatever respiratory emergency he may encounter.

Asphyxia, depending on its severity, may cause death in a few minutes if treatment is not given immediately. The word asphyxia is derived from the Greek and means, literally, without a pulse. In modern usage the word connotes, in addition, an acute oxygen deficiency, usually an acute, severe type of anoxic anoxia.

Asphyxia can be caused by a wide variety of abnormal conditions within the body and in the external environment. Flagg[1] has listed 20 causes of asphyxia, which include those conditions producing asphyxia neonatorum, industrial gases and fumes, drugs, pulmonary diseases, war wounds, submersion, smoke inhalation, electrocution, strangulation, poliomyelitis, and anoxia from manholes and wells.

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A physician is rarely at hand to treat asphyxiations which occur in the home, on the street, in the factory, or at the seaside. The fire department inhalator squad is usually the first on the scene, and it is this team which administers oxygen to the stricken patient.

The clinical picture of acute asphyxia can be extremely variable and the diagnosis difficult, depending on the etiology and the degree of asphyxia.[2]

The treatment of acute asphyxia is to restore oxygen to the patient as rapidly as possible. The means by which this is done will depend on the etiology of the asphyxia.

Thirty cases of acute asphyxia seen in three Chicago hospitals between 1951 and 1954 are reported.

The causes of the asphyxias are distributed as follows: infection, local and general (four); foreign bodies of air and food passages (nine); traumatic injuries of the upper respiratory tract (five); drug and chemical intoxications (three); neoplastic diseases of the respiratory tract (three); and miscellaneous causes, including tracheotomy-tube accidents, cerebral-vascular accidents, and head injuries (six).

The anatomical sites of the asphyxiations were as follows: oral pharynx and hypopharynx, 6; laryngeal lesions, 11; lesions of the tracheobronchial tree, 7, and conditions of the body as a whole, 6.

ASPHYXIA CAUSED BY INFECTION

There were two cases of laryngotracheobronchitis with such sudden progression of

symptoms that they can be considered as acute asphyxia.

CASE 1.—A 5-year-old white girl was seen at her home by her family physician at about 3 a. m., Jan. 23, 1952. He found a cyanotic, stridulous, stuporous child who was acutely ill and in acute respiratory distress. Without hesitation, he passed a Mosher lifesaver tube and called the Chicago Fire Department ambulance, which took the child to Cook County Hospital. A tracheotomy was performed at 4 a. m., and antibiotic therapy was given. The patient left the hospital Feb. 14, 1952, after extubation.

CASE 2.—An 18-month-old white boy was admitted to Cook County Hospital Jan. 31, 1952, with the diagnosis of acute laryngotracheobronchitis. The patient was seen in the steam room by the ear, nose, and throat resident soon after admission. During his examination the patient lapsed into a stupor and became cyanotic. The child was intubated with a bronchoscope immediately, an airway established, and a tracheotomy performed. Antibiotic therapy was given. The patient recovered and left the hospital Feb. 20, 1952, after being extubated.

CASE 3.—A 35-year-old Negro man was admitted to the Cook County Hospital ear, nose, and throat ward Dec. 13, 1951, at 8 p. m. He suffered from hoarseness and dyspnea due to a laryngitis sicca, secondary to generalized Boeck's sarcoidosis. By morning he was only slightly improved, and mirror laryngoscopy showed a narrowed glottis further narrowed by thick dark crusts which adhered to the edges of each cord. An attempt was made to loosen the crusts by spraying the larynx with 2% tetracaine (Pontocaine) and by instilling isotonic saline solution into the laryngeal lumen with a laryngeal syringe. A few crusts were loosened and the patient's dyspnea was somewhat improved. He was taken on a stretcher to his bedside, which was about 30 ft. from the ear, nose, and throat operating room. As he climbed from the cart into his bed, he coughed and dislodged a large crust from the subglottic region, which instantly completely occluded his glottis. Since the patient was making vigorous respiratory movements of his chest without any gaseous exchange, he was quickly carried back to the operating room. Within seconds a Jackson laryngoscope and bronchoscope were obtained, and by the time an airway could be established by forcing the bronchoscope through the glottic and subglottic crusts the patient was completely flaccid. Manual artificial respiration was performed while oxygen was insufflated through the bronchoscope. The patient soon recovered consciousness, and a tracheotomy was done. The patient was discharged Jan. 26, 1952, wearing a tracheotomy tube, and he is now under therapy for laryngeal stenosis, which has subsequently developed from extension of the sarcoidosis to the larynx.

Asphyxiating laryngospasms frequently occur in severe tetanus infections as a part of the generalized spasms characteristic of the disease.[8]

CASE 4.—A 40-year-old white woman was admitted to Cook County Hospital Sept. 13, 1951, with diagnosis of generalized tetanus, the result of an infection in her left leg which had occurred two weeks previously. Her symptoms progressed rapidly after her admission. At 7 a. m., Sept. 15, she had a severe generalized spasm and associated laryngospasm and became deeply cyanosed. Only the administration of 7.5 grains (0.5 gm.) of amobarbital (Amytal) sodium intravenously prevented her from dying at that time. She was further sedated but had another spell of cyanosis at 10 p. m. the same day. A tracheotomy was performed at 11 p. m. Because of continued generalized spasms, a bronchoscope was inserted through the tracheotomy, and frothy serous fluid was found in all branches of the tracheobronchial tree, indicating pulmonary edema. Despite the improvement in the patient's color which followed this procedure, she died Sept. 18, 1951.

It is a common finding at autopsy of those drowned by submersion to discover evidence of pulmonary edema. This patient developed pulmonary edema from the repeated laryngospasms, and this respiratory complication played a major contributing role in her death.

ASPHYXIA CAUSED BY TRAUMATIC LESIONS OF UPPER RESPIRATORY TRACT

CASE 5.—A 59-year-old white man was admitted to the neurosurgical service of Cook County Hospital April 28, 1952, the victim of a gunshot wound. The bullet entered the right side of his head just behind the eye and emerged at the angle of the jaw on the left side. Soon after admission, the patient's condition became critical and he lapsed into a stupor. Ear, nose, and throat consultation was called. Examination showed that the bullet had passed through the base of the tongue and lateral pharyngeal wall and that there was marked swelling of the hypopharynx. In addition, there was much bleeding in the throat, which was being aspirated by the comatose patient. A Jackson laryngoscope was passed and, through this, a bronchoscope into the trachea. The entire tracheobronchial tree was filled with bloody mucus. When the air passages were cleared a tracheotomy was

performed. The patient improved gradually in the next few days. He was discharged from the hospital three weeks later after extubation.

CASE 6.—A 34-year-old Negro man was admitted to Cook County Hospital April 18, 1952. He had sustained an ax wound of the neck shortly before admission. On examination a 20 cm. gaping wound of the neck at the level of the cricoid cartilage was seen. The patient was comatose, and blood, mucus, and air bubbled from the neck wound, which gaped enough for the patient to get enough air to stay alive. When a bronchoscope was passed through the wound to the trachea, a tremendous amount of aspirated blood was expelled from the tracheobronchial tree. A tracheotomy was performed well below the cut airway, and the wound was closed anatomically. The cricoid was crushed by the ax blow, and both recurrent nerves were severed. The patient recovered but was discharged from the hospital June 6, 1952, wearing a tracheotomy tube because of bilateral recurrent nerve paralysis. He did not return for further therapy.

CASE 7.—A 74-year-old white man underwent a radical neck dissection at Cook County Hospital for a metastatic carcinoma of the left side of the neck, Jan. 9, 1952. He had had a carcinoma of the left tonsil treated with radiation therapy six months before. The primary lesion had responded well, and there was no local recurrence. The surgical procedure went well, and the patient's condition was good at the end of the operation. The usual pressure dressing with mechanics waste was applied. However, when the endotracheal tube was withdrawn, the patient stopped breathing and became cyanotic almost immediately. He was reintubated with a Jackson laryngoscope and a bronchoscope, and a tracheotomy was performed. The patient was extubated one week later and left the hospital Jan. 28, 1952, to be followed in the tumor clinic.

CASE 8.—A 52-year-old white man was seen in the outpatient clinic of the Cook County Hospital ear, nose, and throat service at 3 a. m., April 23, 1952. Two days before at another hospital he had had a laryngofissure with cordectomy for carcinoma of the vocal cord. A tracheotomy had been performed at the time of the surgery. About 18 hours before admission to Cook County Hospital, the tracheotomy tube had been removed. After removal of the tracheotomy cannula an unusual train of events occurred. At noon of April 22, three hours after extubation, the patient was slightly restless. At 6 p. m. he was very restless. At 10 o'clock in the evening he was extremely agitated and it became necessary to apply full restraints. At 1 a. m., April 23, the patient became maniacal and the police ambulance was called to remove the patient to Cook County Psychopathic Hospital because it was no longer possible to control him. Examination disclosed an extremely dyspneic patient who was able to force only the slightest air exchange through the recent tracheotomy wound, which had almost completely closed. The wound was spread with a curved 6 in. hemostat, and a No. 4 tracheal cannula was inserted into the trachea. The maniacal symptoms immediately vanished. The rapid respirations returned to normal. A No. 6 tracheal cannula was then inserted. The patient was observed until it was certain that he was breathing well, and he was then sent back to the hospital from whence he had come.

CASE 9.—A 30-year-old Negro woman was admitted to the Cook County Hospital ear, nose, and throat service Jan. 8, 1951. She had a midline neck mass, which had been diagnosed as a thyroglossal cyst. Surgical removal of the cyst was performed Jan. 9, 1951. The postoperative course was uneventful until the second day, when the patient began to complain of difficulty in breathing. A mirror laryngoscopy at 8 p. m. Jan. 11 showed edema of the epiglottis and arytenoids. The examining resident observed that the airway was narrowed, but he considered it adequate. One hour later the patient was found dead in her bed.

Edema of the laryngeal structures is common after surgical removal of thyroglossal cysts and other neck operations. This patient progressed to a rather sudden fatal asphyxia from laryngeal edema.

ASPHYXIA DUE TO FOREIGN BODIES IN THE AIR AND FOOD PASSAGES

Nine cases of asphyxia due to foreign bodies in the air and food passages are presented.* There were five in which the foreign body lodged in the hypopharynx to cause asphyxia.

CASE 10.—A 2-year-old white girl was seen in the emergency room of Resurrection Hospital. Her mother said that while the child was eating her chicken dinner she began suddenly to choke and gag. The patient's mother put her finger in the child's throat and, feeling a piece of meat, made an attempt to dislodge it. She was successful because the patient no longer choked or gagged, but she noticed that the patient was no longer able to breathe through her nose. As the child was being examined by the physician, she retched and a large piece of the cartilaginous end of the second

* Jackson and Jackson,[2] Section III.

joint of the chicken leg dropped from the nasopharynx and was removed from the oropharynx. Had not the mother dislodged this foreign body from the larynx to the nasopharynx the child would have quickly asphyxiated.

CASE 11.—A 2-year-old white girl entered the ear, nose, and throat clinic of Cook County Hospital April 5, 1952. The child was cyanotic, and her mother was holding her upside down. She had been given a piece of candy 2 cm. in diameter in the clinic waiting room. Soon after putting the candy in her mouth, she had begun to choke and her respirations had become labored and crowing. A laryngoscope was procured, but before anything could be done she coughed the foreign body out of her mouth. Her respirations immediately became normal, examination was negative, and she was sent home with a warning to her mother of the dangers of foreign bodies.

CASE 12.—A 6-week-old Negro girl was admitted to Cook County Hospital May 12, 1952, in acute respiratory distress. Her mother had noticed that the child had suddenly, and for no apparent reason, begun to breathe heavily one hour before. Ear, nose, and throat consultation and examination showed a child in acute respiratory distress with crowing inspiration and retractions of the infracostal and supraclavicular and infraclavicular regions. With the use of a tongue blade a foreign body could be seen in the hypopharynx. A laryngoscope was inserted, and a small plastic toy spoon was found lying in the hypopharynx so that the bowl of the spoon lay over the laryngeal aditus, acting as a one-way valve. Air was easily expelled, but on inspiration the spoon was drawn over the aditus, causing obstruction. The spoon was withdrawn, and the respiration and color readily improved. The patient was discharged without further difficulty, May 17, 1952.

CASE 13.—A 13-month-old Negro boy was admitted to the emergency room of Cook County Children's Hospital Dec. 25, 1954, in extremis. The patient was unconscious and was breathing with an audible stridor. The pediatric resident obtained the history that the patient had suddenly begun to cough at home. He developed respiratory difficulty and was brought to the Cook County Hospital. The child was prepared for an emergency tracheotomy by the pediatrician but, just as he was about to incise the skin, the patient coughed with great force, took a deep breath, and opened his eyes. One hour later an infant bronchoscope was passed into the tracheobronchial tree through a laryngoscope and no abnormality was seen. No foreign body was found in this case, but there can be no doubt that there was a foreign body in the region of the larynx which was coughed out and swallowed.

There were four cases of foreign bodies in the tracheobronchial tree which caused asphyxia.

CASE 14.—A 15-month-old white boy was brought to Cook County Hospital April 16, 1952, by his mother. Just outside she met the ear, nose, and throat resident, who, noting the stridor and cyanosis of the comatose patient, directed her to the examining room and hurried to get a laryngoscope and bronchoscope. As the bronchoscope was being passed, the pediatric resident took the child's history. He learned that the child had put a handful of dried beans into his mouth earlier in the day and had coughed and choked at that time. Examination at another hospital, however, was negative, and the child was sent home, only to begin to have an increasing respiratory difficulty soon after. Since the condition became worse rapidly, the child was taken to the nearest hospital. Three dried beans of assorted sizes were found and removed from the trachea and right and left main bronchi. Because the procedure of establishing an airway and removing the foreign bodies took 45 minutes, a tracheotomy was performed to prevent any further respiratory distress from laryngeal edema. Next morning the patient was normal and was transferred to another hospital for further care.

CASE 15.—A 3-year-old Negro girl was admitted to the ear, nose, and throat clinic of Cook County Hospital in critical condition May 19, 1952. The child was in respiratory distress, the pulse was rapid and thready, the respirations were rapid and shallow, and breath sounds were absent over the entire right chest. An emergency chest film showed massive collapse of the right lung. The patient's condition became swiftly worse, and when she was brought into the operating room she was stuporous. A bronchoscope was passed through a laryngoscope into the trachea, and a large peanut was found and removed from the right main bronchus. The patient's condition improved steadily for the next few hours, and she was alert and well within four hours. Her convalescence was delayed by a laryngeal edema that developed 24 hours later and required a tracheotomy for relief. She was extubated without difficulty and was discharged from the hospital June 13, 1952.

CASE 16.—A 2-year-old Negro boy was admitted to the Cook County Children's Hospital Nov. 6, 1954, at 3 a. m. The child's mother said that the child had choked on a peanut about 36 hours before but had had no further symptoms until he developed difficulty in breathing, about one hour before admission. One of the junior ear, nose, and throat residents mistakenly advised that treatment could wait until morning. When the child

was seen at 9 a. m. the next day he was pallid, comatose, and in a deep state of shock. No breath sounds could be heard over the right chest, and the cardiac apical impulse was displaced far to the left. He was taken to the operating room without delay, where a bronchoscope was passed through a laryngoscope and a peanut was found and removed from the right main bronchus. His condition improved under oxygen therapy, and he was alert and happy in about four hours. It was later learned that a chest x-ray had been taken at 8 a. m., before bronchoscopy. This showed a severe obstructive emphysema of the right lung with shift of the mediastinum to the left. The patient was discharged from the hospital Nov. 20, 1954.

Case 17.—An 18-month-old Negro boy was admitted to the Cook County Children's Hospital Oct. 4, 1954, in coma and deep shock. His mother denied that the child had had any exposure to possible foreign bodies. During the course of the examination the patient had a generalized grand-mal type of convulsion, which was controlled by amobarbital sodium intravenously. The examining pediatrician noted a loud expiratory wheeze and an audible slapping noise that could be heard at least 2 ft. from the patient. He called an emergency ear, nose, and throat consultation. Because of the desperate condition of this patient, a bronchoscope was passed through a laryngoscope into the trachea of the child on the pediatric ward. A large, dry navy bean was found in the trachea oscillating between the carina and the subglottic region. The bean was removed, and the patient was placed in a high-humidity oxygen tent. In about four hours he was alert and fully recovered. He was discharged Oct. 10, 1954.

One case of tracheal encrustation caused acute asphyxia.[4]

Case 18.—A 65-year-old white man underwent a total laryngectomy for carcinoma of the larynx in 1946 at Cook County Hospital. He had been free of recurrences of carcinoma but had been coming to the ear, nose, and throat clinic at Cook County Hospital periodically for removal of crusts which formed in his trachea. The patient came to the clinic Feb. 15, 1952. He must have had extreme difficulty getting as far as the clinic, because as he reached the door he fell to the floor unconscious, became cyanotic, then pale and pulseless. An anterior-commissure laryngoscope was immediately passed through the tracheal stoma, and a cast of almost the entire trachea was removed with a laryngeal alligator forceps. Manual artificial respiration was immediately begun, and oxygen was insufflated into the trachea. Within about 10 minutes the patient opened his eyes, and in about two hours he was completely recovered. He is still being followed in the tumor clinic of Cook County Hospital.

ASPHYXIA CAUSED BY DRUGS AND CHEMICALS

There were three cases of acute asphyxia caused by drugs and chemicals. Two cases were caused by morphine and its derivatives and one by a plant insecticide that contained nicotine.[5]

Case 19.—On the morning of Nov. 4, 1952, a 70-year-old white man had a laryngectomy performed at St. Luke's Hospital, because of carcinoma of the larynx. His immediate postoperative condition was good. At 5 p. m. he was given 1/10 grain (4 mg.) of dihydromorphinone (Dilaudid) by hypodermic injection for pain. At 8 p. m. that evening he rather suddenly became stuporous. His respirations were deep and gasping, at a rate of about 6 per minute. His pulse rate was 88 per minute, and his blood pressure was 80/40. Oxygen was insufflated into his tracheotomy tube, an intravenous transfusion of whole blood was begun, and he was given 0.5 gm. of caffeine and sodium benzoate by subcutaneous injection. This had no effect on his condition. Five milligrams of nalorphine hydrochloride (Nalline), a specific antimorphine drug, was then injected intravenously. In about three minutes after this injection the patient awoke and looked about. Another 5 mg. was injected, which caused further improvement in his condition. His respiration rate became normal, and his blood pressure rose to 130/80. The rest of his convalescence was uneventful, and he was discharged from the hospital 10 days later.

Case 20.—A four-year-old white boy was seen at a physician's office and given two doses of morphine to facilitate removal of a small metal key chain that he had put in his left nostril. The physician was unable to remove the foreign body, and he referred the patient to Cook County Hospital. He came to the ear, nose, and throat clinic Oct. 21, 1951, about two hours after having received the last dose of morphine. As he sat waiting to be examined, he lapsed into a stuporous state, became cyanotic, and began to breathe at a rate of about 4 per minute. A laryngoscope was passed, but the upper airway was found to be clear and unobstructed. An endotracheal tube was passed, and he was given artificial respiration for one hour by positive pressure with the use of an anesthesia machine. He was given 200 mg. of caffeine and sodium benzoate by subcutaneous route. After this treatment he began to breathe spontaneously at about 20 per minute. He was then taken to fluoroscopy, where the key chain was noted in the stomach. He was

then admitted to the Children's Hospital for observation and was discharged two days later.

CASE 21.—A 52-year-old white woman was admitted to Cook County Hospital June 16, 1952, at 10 p. m., receiving artificial respiration from the Chicago Fire Department inhalator squad. She had taken an unknown dose of a plant insecticide that contained nicotine as its active ingredient about two hours before admission and had become comatose shortly thereafter. Upon arrival her blood pressure was 130/90, her pulse rate was regular at 90 per minute, and her color was good. The patient was placed in an iron lung. As soon as the respirator was started and the inhalator mask was removed, the patient became cyanotic and pulseless. An ear, nose, and throat consultation was called. Examination showed that there was no air exchange because the completely flaccid pharyngeal and lingual structures obstructed the upper airways. The patient was intubated with an endotracheal tube, and an airway was reestablished. In spite of a slight improvement in her condition, the patient died the next day at 6 a. m.

Nicotine in large doses paralyzes striate muscles and will cause death from respiratory paralysis. This patient's respirations were maintained satisfactorily until she was put in the respirator. She suffered a fatal asphyxia due to what Jackson has called the lingual check valve.†

ASPHYXIA DUE TO NEOPLASTIC DISEASES OF THE RESPIRATORY TRACT

CASE 22.—A 2-year-old Negro girl was seen in acute respiratory distress Sept. 20, 1952, at Cook County Children's Hospital. The child had been tracheotomized for acute laryngotracheobronchitis at the age of 6 months and had worn a tracheal cannula continuously because all attempts to extubate her had failed. She had developed a laryngeal stenosis, due to unknown causes, but was being maintained satisfactorily with a No. 2 Jackson tracheotomy cannula. At 1 p. m. Sept. 20, she began to have difficulty in breathing. By 2 p. m. she was cyanotic and in great distress, breathing rapidly at about 60 per minute. There were deep intrasternal and supraclavicular retractions. The ear, nose, and throat resident who was called to see her changed her tracheotomy tube, but she was not relieved. A 4 mm. bronchoscope was then passed into the trachea through the tracheal stoma, and a granuloma 5 mm. in diameter was seen arising from the posterior tracheal wall about 2 cm. below the tracheotomy. This was freely movable on a rather broad base and had been blocking the trachea and the tracheal cannula almost completely. With some difficulty, the granuloma, which was histologically benign, was removed, and the patient's respirations returned to normal through the tracheotomy tube. She was discharged to another hospital for further care in June, 1952.

CASE 23.—A 72-year-old white man was admitted to a medical ward of Cook County Hospital Jan. 6, 1952, because of dyspnea. After admission, his dyspnea became progressively worse. The intern assigned to the case noticed an inspiratory stridor and called an emergency ear, nose, and throat consultation. Ten minutes later, the ear, nose, and throat resident found a comatose, pallid patient breathing about five times a minute. There was no pulse obtainable. A laryngoscope was passed, and a large granulomatous lesion almost completely obstructing the glottic opening was seen. There was much purulent secretion in the hypopharynx and glottis. A bronchoscope was forced through the laryngeal lesion, and an airway was established. Oxygen was insufflated into the trachea through the bronchoscope, and a tracheotomy was performed. In about three hours the patient was alert and fully recovered. A biopsy specimen was later taken, and the lesion proved to be a carcinoma. A total laryngectomy was performed Feb. 27, 1952. The patient was discharged from the hospital in May, 1952.

CASE 24.—A 50-year-old white woman was admitted to the ear, nose, and throat service of Cook County Hospital May 15, 1952, because of extreme dyspnea. Mirror examination of the larynx disclosed laryngitis sicca, with thick crusts obstructing the glottis. The patient responded to conservative therapy, consisting of steam inhalations and instillations of saline and 2% tetracaine into the larynx with a laryngeal syringe. Further examination of the larynx two days later revealed a granular lesion of the anterior halves of both vocal cords which had the clinical appearance of carcinoma. The patient was advised and urged to undergo direct laryngoscopy and biopsy and to have a tracheotomy. She refused all therapy and left the hospital after signing a release May 22, 1952. She was seen again May 27, 1952, at Cook County Psychopathic Hospital. She had been found on the street unconscious three hours before. Examination showed a comatose, cyanotic patient with a respiratory rate of forty per minute and a barely perceptible pulse. A bronchoscope was passed through a laryngoscope into the trachea, and a tracheotomy was done. The patient died 36 hours later without regaining consciousness.

ASPHYXIA DUE TO TRACHEOTOMY-TUBE MISHAPS

CASE 25.—A 62-year-old white man entered Cook County Hospital ear, nose, and throat service

† Jackson and Jackson,[2] p. 136.

March 22, 1952, because of dyspnea due to an extensive carcinoma of the larynx. An emergency tracheotomy was performed on admission, and the patient's dyspnea was relieved. At 2 a. m. March 25, he again became dyspneic and cyanotic, his blood pressure fell to 68/38, and his pulse became rapid and thready, with a rate of 130 per minute. The intern began to treat the patient for shock. An intravenous infusion of isotonic saline solution was started, 0.5 cc. of 1:1000 epinephrine was injected subcutaneously, the patient was placed in the Trendelenburg position, and oxygen was started by nasal catheter. When the patient did not improve, the intern removed the inner cannula of the tracheotomy tube. The patient's dyspnea instantly disappeared, and in a few seconds his color returned to normal. A large crust that occluded about 95% of the lumen of the tracheotomy tube was found in the inner cannula.

CASE 26.—A 15-year-old white boy was admitted to Cook County Contagious Hospital Aug. 29, 1954, with a diagnosis of acute bulbar poliomyelitis. Because of increasing respiratory difficulty, a tracheotomy was performed Aug. 30, 1954. The patient improved slowly and steadily until he was extubated Oct. 16, 1954, after having worn his tracheotomy tube occluded for one week as a test of the adequacy of his pharyngeal and laryngeal reflexes. At 1:30 p. m. the next day the patient suddenly became cyanotic. The ear, nose, and throat resident on call arrived about five minutes later and found the patient deeply cyanosed and unconscious. A curved 6 in. hemostat was inserted into the trachea through the recently closed wound and opened to dilate the wound, and a No. 6 tracheal cannula was passed into the trachea. The patient's color improved, and the patient recovered. He was extubated safely one month later and discharged from the hospital Nov. 18, 1954.

CASE 27.—A 5-year-old Negro girl was admitted to Cook County Children's Hospital Sept. 18, 1950, because of a tuberculous infection of the fourth and fifth lumbar vertebral bodies. While under therapy she developed a laryngeal tuberculosis, which caused respiratory obstruction. A tracheotomy was performed April 16, 1951. Her tracheal cannula was changed weekly, and she was progressing satisfactorily until Nov. 22, 1951, when she began to have hemoptysis. At 10 p. m. she coughed up about 100 cc. of blood through her tracheotomy tube. After aspiration of the cannula her airway was clear and the patient appeared normal. Forty-five minutes later she was discovered dead in her bed. Her tracheal cannula was found at the foot of the bed. The patient had apparently had a severe coughing spell, clutched at her throat, and pulled the tracheotomy tube out. Unable to cry because of the laryngeal stenosis, she asphyxiated.

CASE 28.—An 18-month-old Negro boy was admitted to the Cook County Children's Hospital Jan. 14, 1951, with a diagnosis of acute laryngotracheobronchitis. Because of severe dyspnea, a tracheotomy was done two hours after admission. The patient was afebrile four days post-tracheotomy. On Jan. 25 at 10:30 a. m. the tracheotomy tube was removed and the patient was observed closely to determine if he could be extubated. He became slightly dyspneic at the end of 30 minutes, and an attempt was made to reinsert the tracheal cannula. The cannula would not pass through the tracheal stoma because of edema. An attempt to force the cannula caused bleeding. This aggravated the dyspnea, which was becoming acute. An attempt was made to pass a Mosher lifesaver tube through the mouth and larynx, but the patient became deeply cyanotic and spastic, and died.

ASPHYXIA IN CENTRAL NERVOUS SYSTEM DISORDERS

CASE 29.—A 51-year-old white woman was admitted to the medical service of Cook County Hospital Jan. 4, 1952, in coma. She was a known hypertensive and had suddenly become comatose at home. Soon after admission the patient became totally apneic, but her blood pressure continued to be 180/110. Her pulse rate was 108. She appeared to have suffered a massive cerebrovascular accident. Manual artificial respiration by compressing the lower half of the supine chest was carried out until an endotracheal tube could be inserted and bag breathing with the anesthesia machine begun. She was placed in an iron lung and the endotracheal tube was left in place. A good gaseous exchange was maintained. She died at 6 o'clock the next morning.

CASE 30.—A 20-year-old white woman was admitted to Resurrection Hospital Dec. 18, 1953, in coma. She was taken from the wreckage of an automobile which had been struck by a train. Her respirations were labored at 45 per minute. She was in deep shock, with a blood pressure of 60/40 and a pulse rate of 140. She was cyanotic. When an endotracheal tube was passed into the trachea and considerable secretions were aspirated, her respiration and color returned to normal. She was given intravenous fluids, oxygen, and supportive care. Thirty-six hours later she was still comatose but again became cyanotic. A catheter could no longer be passed through the endotracheal tube, and the exchange of air through the endotracheal tube was decreased markedly. After a tracheotomy was performed, the patient had no further respiratory obstruction. The endotracheal tube was found to

have a large obstructing crust at its distal end. The patient gradually improved and was discharged two months later from the hospital.

SUMMARY

Thirty illustrative cases of acute asphyxia seen by the otolaryngologist are presented. These cases demonstrate that the otolaryngologist must be aware of more than the mere indications and techniques of the tracheotomy operation. He must be familiar with all modes of therapy of acute asphyxia and be ready to apply them in the treatment of patients in acute respiratory distress.

REFERENCES

1. Flagg, P. J.: The Art of Resuscitation, New York, Reinhold Publishing Corporation, 1944, pp. 32-33.

2. Jackson, C., and Jackson, C. L.: Broncho-esophagology, Philadelphia, W. B. Saunders Company, 1950, pp. 127, 136, and 165.

3. Cecil, R. L.: A Textbook of Medicine, Philadelphia, W. B. Saunders Company, 1944, p. 196.

4. Conley, J. J.: Diagnosis and Treatment of Encrustations in the Trachea, J. A. M. A. **154**:829-832, 1954.

5. Goodman, L., and Gilman, A.: The Pharmacological Basis of Therapeutics, New York, The Macmillan Company, 1941, pp. 490-491.

Audiology Section

JOSEPH SATALOFF, ASSOCIATE EDITOR

Conservation of Hearing in a Small Town

GUY O. PFEIFFER, M.D., Mattoon, Ill.

Deafness in the student of the elementary and secondary schools remains a challenge to educators, parents, and to the physician. Education of the parent and the instructor, of the student, is one of the keynotes of its possible correction. The family physician and the otologist must be ever on the lookout for minimal deafness or have the problem referred to them for diagnosis and possible therapy.

The parent often honestly believes the student is daydreaming and thus does not pay attention when spoken to. The parent often tells the examiner, "My Johnny hears when it is something he wants to hear, but never hears when asked to do something."

The instructors, in their busy schedule, often believe the same of the student and do not have the time to delve into the individual problem.

Many articles have appeared in the journals concerning state-wide and metropolitan investigations of youth hearing problems. This thesis deals with the methods of setting up, the mechanics of, and the findings and results of a hearing survey conducted in a school unit in which the total population of the unit area is less than 30,000.

The elementary and secondary school district board requested that the school health service devise some means, in cooperation with local physicians, by which the parents and instructors would become more aware of the hearing status of the students. The plan, which eventually became practical and met the approval of the local medical society, took only a few weeks to develop but a year to be fully accepted. The program involved many factors, among which the most important were parent cooperation and allaying the fear of the family doctor that the patient was not lost to the specialist.

A tentative plan was worked out in cooperation between the school health department and interested otolaryngologists. The nurses then presented the problem to the physicians at a hospital staff medical meeting. The plan was accepted.

The program is as follows: One-half of all students, about 4000 in total number, were examined individually at the 15 db. level by a school nurse or by a P. T. A. mother under the supervision of the school nurse. All students were examined from 128 to 11,584 cps in each ear. Air-conduction tests only were done. Any student failing this screening test was rechecked by a nurse trained in audiometric recording, and when the student failed this second examination, the next step was taken. The school health department then sent a questionnaire to the parents asking their permission and cooperation and requesting that an enclosed form be filled out. This form embraced past health, diseases, operations, family physician, family otolaryngologist, etc. Each year one-half of the students are examined; thus each student is checked every two years. All students with hearing problems are checked annually or semiannually.

The parents were then invited to bring their child to a hearing clinic at a specified time and place. The clinic consisted of two

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or three otolaryngologists, the school nurses, volunteer P. T. A. mothers, and the nursing office secretary. The local otolaryngologists examined the student and noted their findings, tentative diagnoses, and recommendations. Findings, suggestions, and advice were not discussed with the student or parent. It was explained to them that the doctor examining was not their personal physician and that the results of the examination would be sent to their physician of choice and they would be advised by him and him only. These reports were delivered to the personal physician within three days. Only those cases which were thought to possibly be improved by therapy or in which further evaluation was needed were referred to their personal physician.

At all times it was stressed that the relationship between the family doctor and the specialist in a small town is a delicate one, and it is only ethical that the patient reserve the right to choose his physician and that the physician refer the patient to a specialist if he deems it necessary.

The health office mailed these individual reports to the student's physician, or otologist, or to both. The parents were requested to contact him. In cases where parents were tardy, the nurses made personal home calls to follow up their initial work to attempt to get all students cared for or at least to have consultation with their doctor of choice.

In most cases, there was full cooperation between school, parent, and doctor. In a few

TABLE 1.—*Results of Hearing Studies Made on Students*

Students	1950-1951		1951-1952		1952-1953		1953-1954	
	No.	%	No.	%	No.	%	No.	%
Part 1								
Total enrollment	3500	....	3700	....	3900	....	4000	....
Examined by hearing survey	1453	41.5	1840	49.7	1809	46.4	2242	56
Referred to hearing clinic	164	11	93	5	44	2.4	38	1.7
Part 2								
Referred to hearing clinic	164	....	93	....	44	....	38	....
Examined at hearing clinic	116	70.7	83	89	28	63.6	24	63
Did not report to hearing clinic	48	29.3	10	11	16	36.4	14	37
Part 3								
Examined at hearing clinic	116	....	83	....	28	....	24	....
Found normal or advised no treatment	7	6	12	14	5	18	2	8
Referred to physician	109	94	71	86	23	82	22	92
Part 4								
Referred to physician	109	....	71	....	23	....	22	....
Examined by physician	68	62.3	42	60	17	74	12	55
Not examined by physician	34	31.2	21	30	3	13	9	41
Moved from area and no follow-up available	7	6.5	8	10	3	13	1	4
Part 5								
Not examined by physician and no treatment received	34	....	21	....	3	....	9	....
Normal following survey	20	59	15	71	1	33	5	55
Abnormal following survey	14	41	6	29	2	67	4	45
Part 6								
Examined and treated by physician	68	....	42	....	17	....	12	....
Normal after treatment	37	54.5	21	50	12	71	8	67
Improved after treatment	20	29.5	15	36	1	6	3	25
Not improved after treatment	11	16	6	14	4	23	1	8
Part 7								
Examined and referred for further care	109	....	71	....	23	....	22	....
Normal or improved following survey	77	71	51	72	14	61	16	73
Not normal following survey	25	23	12	17	6	26	5	23
Moved or graduated	7	6	8	11	3	13	1	4
Part 8								
Not normal following survey	25	....	12	....	6	....	5	....
Not normal after treatment	11	44	6	50	4	67	1	20
Not normal after no treatment	14	56	6	50	2	33	4	80

cases parents did not care or made little of the program, but in a year's time all doctors were in favor of the program.

In cases of financial hardship, the school nurses made a social service investigation. The student was cared for by his personal physician, and all expense was borne by certain service and fraternal organizations of the local area.

TABLE 2.—*Students Classified According to Diagnosis*

Diagnosis	1950-1951	1951-1952	1952-1953	1953-1954
Rechecks of condition of previous year	..	5	5	1
Enlarged tonsils and adenoids	60	18	9	10
Adenoids	10	19	1	6
Rhinopharyngitis and possible allergy	24	34	8	4
Chronic otitis media	9	3	2	2
Nerve deafness	4	1	2	..
Normal	..	8	1	1
Total	116	88	28	24

The results are best presented and understood in a tabulated report. The initial studies were started in the fall of 1950, and complete studies were made through the 1953-1954 school term.

The follow-up for drawing of conclusions was done by home social service visits by the school nurses. They tabulated whether treatment was effected as advised, suggested, or referred to the specially trained medical personnel. Follow-up audiograms were done in all cases; and whenever cases were picked up not responding to care, not treated, or suddenly showing an abnormal depression of hearing, those cases were again referred to the next hearing clinic for further evaluation.

The program has now reached the stage of a standard program with full cooperation of parent, school, and physician. The program is not without its faults, but in spite of not enough trained personnel and inadequacy of proper audiometric rooms, it has served its original purpose to the school-age youth.

In retrospect, we have found that many abnormal hearing problems have become normal, especially in the classification of hypertrophic lymphoid tissue due to these factors: (1) treatment of allergic rhinitis, (2) recession of lymphoid tissue at puberty, (3) disappearance of acute infections, and (4) examinations made during the fall of the year giving a certain finding and those in the spring giving another finding due to change of the infectious state of the upper respiratory tract.

Link Clinic.

Case Reports

LYMPHOSARCOMA OF THE TONSIL

A Long Survival

JOHN J. RAINEY, M.D., Troy, N. Y.

LYMPHOSARCOMA of the tonsil is one of the most radiosensitive of all malignant growths. The five-year survival rate is about 25%. Stout [1] reports two patients who survived more than 10 years. One was well for 13 years and 11 months; the other died at the end of 13 years and 8 months, but not from recurrence.

The following is the report of a patient with lymphosarcoma of the tonsil who has survived almost 40 years.

A married woman, aged 44, was examined late in December, 1919. For one month she had complained of sore throat and a hacking cough. The picture was that of a peritonsillar abscess of the left tonsil. Just one year before, 1918, a patient was seen with what appeared to be a peritonsillar abscess, which was incised. The condition, however, proved to be a fulminating lymphosarcoma of the tonsil, and the patient died a year later of a generalized sarcomatosis.

With that in mind, and because there was a decided resemblance between the throat of the recent patient and that of the patient who had died, it was decided not to incise the apparent abscess but to await events.

As the picture had not changed one week later, a tonsillectomy was performed at the Leonard Hospital, Troy, N. Y., on Jan. 5, 1920. The left tonsil was considerably larger than the right, pearly pink in color, and it was enucleated in its entirety. A tentative diagnosis of lymphosarcoma of the left tonsil was made.

The tonsils were sent to Dr. Ellis Kellert, Director of the Bender Laboratory, Albany, N. Y. His report was lymphosarcoma of the left tonsil. The right tonsil showed no evidence of tumor. Less than three weeks later, the patient was sent to Dr. Arthur C. Heublein, of Hartford, Conn., for radium therapy. Six weeks later, although there was no recurrence, she received radium therapy again.

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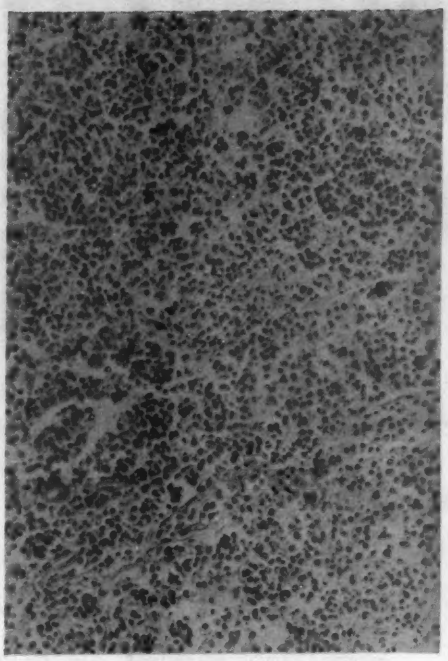

Fig. 1.—Lymphoblastoma of the tonsil; reduced from mag. × 150.

Thirty-six years later, Dr. Kellert, now Director of the Ellis Hospital Laboratory, Schenectady, N. Y., reexamined the slides and prepared the low-power and high-power photomicrographs. Dr. Kellert's description of the tumor is as follows:

"Left Tonsil: Section of the tumor shows a lymphoblastic type of tumor. Most of the cells lie somewhat loosely in spaces formed by reticulum or narrow fibrous bands. The tumor cells vary from small lymphocytic to much larger lymphoblastic types. The nuclei are large and nucleoli prominent. Many mitotic figures are present. There is an occasional large multi-nucleated cell but no distinct Reed-Sternberg cells. Eosinophils are not present. Diagnosis—Lymphoblastoma (lymphosarcoma)."

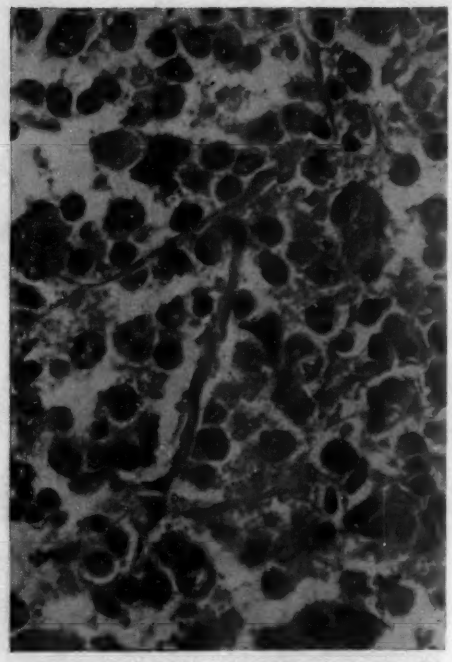

Fig. 2.—Lymphoblastoma of the tonsil; reduced from mag. × 500.

COMMENT

Down through the years at no time has there been cervical node enlargement and there has been no recurrence of tonsillar growth. The patient is now 80 years of age; her mind is crystal-clear, and she is in excellent health. Performing tonsillectomy promptly and refraining from opening the left tonsil (thus breaking down protective barriers) proved to be of benefit to the patient. This, combined with early radium therapy, probably saved her life.

CONCLUSION

This report of almost 40 years ago seems a distant memory, but that was the time. And it would suggest, when the happy result to the patient is considered, that there is an exact moment when things are done best.

17 Second St.

REFERENCE

1. Stout, A. P.: The Results of Treatment of Lymphosarcoma, New York J. Med. **47**:158-164 (Jan. 15) 1947.

Clinical Notes, New Instruments and Techniques

A NEW UNIVERSAL SAFETY-PIN-CLOSING FORCEPS

A. ALBERT CARABELLI, M.D.
Trenton, N. J.

In 1951 I developed a universal type of grasping forceps which have given excellent satisfaction in the removal of foreign bodies from the air and food passages.[1] Because of a "full view" concept and a principle of closure which was considerably different from those in available types, these forceps have been used over a period of years with considerable success. It was thought that perhaps forceps of the same type for closing safety-pins could be developed which would incorporate a similar principle of closure and at the same time include such improvements as would make such an instrument more effective for these purposes.

The new forceps consists of a handle similar in principle to that used on the universal grasping forceps, an inner and outer cannula, a grasping insert (Clerf-Arrowsmith type), and a special threaded tip. The handle proper is brazed to the outer cannula and incorporates a fast-running screw, a large knurled nut, a binding post, and thumb rest. One small screw in the upper portion of the handle serves to hold the entire assembly firmly in place so that for cleansing purposes simple removal of this screw permits all the component parts to be removed. The inner cannula telescopes into the outer cannula, and its proximal portion is brazed onto a saddle which rides the knurled nut. The tip consists of a drilled and proximally threaded bar to which a terminal pivot has ben brazed. Its lower surface is machined to clear the flexible jaws of the grasping insert.

The principle of closure of the jaws with this instrument depends on a forward movement of the inner cannula over the open grasping jaws when the knurled nut is turned to the right. The grasping insert does not move but is fastened to the binding post. With the jaws engaged, turning of the knurled nut to the right gradually and securely closes the open arms of the pin with a delicate, controlled micromotion.

Since the tip is threaded unto the inner cannula, it and the grasping insert may be rotated to any position of a 360-degree circle to engage the open pin in any presentation while the handle remains in the standard operating position. A small turn of the locking nut in the binding post secures the grasping insert and tip into any of these positions.

To adjust the grasping jaws prior to use, the knurled nut is turned to the "closed" position—next to the handle proper. The grasping insert is then pushed through the binding post eye until the grasping jaws are completely closed and in approximation, with no space in between. The knurled nut of the binding post is then turned to lock the insert in place. Introduction into an endoscope requires the "closed" position. For engagement prior to closure of a pin, the jaws are opened when the tip is beyond the end of the endoscope by turning the knurled nut to the left until a sufficient expansion of the jaws results which will slightly override the arms of the pin. When large pins are concerned, the jaws may have to be widened manually while the instrument is in the "open" position; that is, with the knurled nut next to the binding post, to a sufficient degree to slightly override the arms of the pin. As is usual with these operations, a type of pin similar to the one in the passage is selected for adjustment of the instrument and practice prior to the actual removal.

Pins with approximate measurements of 3, 4, and 5 cm. are the ones in common use in the United States, and all of these may be closed with these forceps. Smaller pins (2 cm.) may also be incompletely closed and removed; however, in this case the security of the point within the keeper is not possible, though the jaws of the grasping insert will cover them sufficiently to prevent withdrawal trauma.

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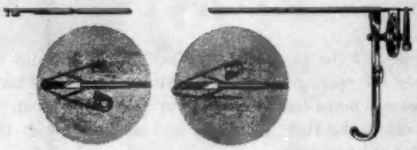
With respect to length and weight, these forceps were designed in one weight and one length (48 cm.), since they are strong enough and still small enough to remove the largest pin through an endoscope of 4 mm. lumen, full or otherwise. For the endogastric work a length of 58 cm. may be desirable, though the problem of the endogastric open safety-pin can be solved more easily by other techniques.

As can be seen from the illustrations, two methods of application are possible with the new forceps. One is by engagement of the pivot in the hole of the spring ring with gentle downward motion. This method gives an exceptionally secure grasp, with no possibility of creating leverages which could lose or permit the pin to spring out from the jaws on withdrawal. The pin is held firmly in the endoscopic axis and will not slip out even when strong traction is applied. This method of application is possible only when the spring hole is present or visible. Some pins have a shield over the spring hole and cannot be thus engaged.

When the above technique is not possible, the pin may be grasped by the second technique. It is only necessary to visualize both arms of the pin when the open jaws are placed over them with a slight downward motion. The only precaution to observe in this application is to see that the pivot is somewhere proximal to the cephalad portion of the spring ring hole and not beyond it. Centering of the pivot or its actual contact with the outside of the ring is not necessary, since this automatically occurs when the jaws begin to close. The pivot is so designed that it will not bind in the angles formed by the arms with the spring-hole wire. When closure begins, the pivot will automatically find its way to either one of these angles. When complete closure is accomplished, a small click will be heard, indicating that the point has snapped into the keeper. Removal at this point may be begun, but it is well to remember that too much traction will result in loss of the closed pin, since in this application it is not held very securely for axis traction



The universal safety-pin-closing forceps, showing the component parts and the two methods of application.

and the jaws may slip over the keeper. This disadvantage is inherent in this application as well as constantly present in other available forceps. It may be advantageous, after closure, to use a second forceps with a more appropriate tip for the actual removal.[1] In the air passages no precautions are necessary, but in the esophagus it would be advantageous to work with the table head down so that loss into the stomach of the closed pin does not occur while the forceps are being changed.

Either one of the above techniques may be used with fluoroscopic removal of open safety-pins while exercising the same precautions and principles of removal.

The forceps described above possesses several distinct advantages in the removal of open safety-pins from the air and food passages when the open point is cephalad. Only one forceps serves for all common sizes of safety-pins. They will enter all endoscopes up to and including a 4 mm. lumen, full or otherwise. They permit two distinct applications: one with the pivot within the spring ring hole, which is the best and the most secure, and the other with the pivot outside the spring ring hole, when this is shielded by a metal cover or not visible. Closure is gradual and controlled with visibility of the "full view" type, since no proximal encumberances impede the field of vision. Finger fatigue is eliminated, since the pin is firmly and constantly held even when the hand is removed or changes positions. This constant grip makes it possible to change the position of the fingers and hand for gentle manipulation, such as disengagement of the point from the tissues after partial closure, etc. Such maneuverability is not possible with other types of closing principles, since release of the grasp immediately frees the pin from the jaws. Another useful feature is the ability to rotate the tip and the jaws to such positions as may be necessary for engagement of the pin in its actual presentation and still maintain the handle in the normal operating position.

Some objection may be raised to the apparent "slow-motion" mechanism inherent in this type of instrument. On the other hand, an open pin, especially in the esophagus, can inflict a rather serious laceration when it escapes from an insecure grasp, because of the powerful spring tension created by partial closure. With this instrument an insecure grasp becomes apparent long before the spring tension becomes too great, and better reapplication is in judicious order. On the other hand, with the scissors type of forceps full spring tension is created almost immediately and escape can cause severe damage. Because of its construction, this instrument almost forces upon the operator a sense of caution and delicacy of manipulation.

These forceps are presently being manufactured by the George P. Pilling and Son Company, 3451 Walnut St., Philadelphia, to whom I have given a working model of the instrument described.

REFERENCE

1. Carabelli, A. A.: A New Universal Grasping Forceps for Endoscopic Removal of Foreign Bodies, A. M. A. Arch. Otolaryng. **54**:718-720 (Dec.) 1951.

Progress in Otolaryngology

FUNCTIONAL EXAMINATION OF HEARING

Summaries of the Bibliographic Material Available in the Field of Otolaryngology for 1954-1955

ALFRED LEWY, M.D.
S. L. SHAPIRO, M.D.
and
NORMAN LESHIN, M.D., Chicago

INTRODUCTION

THE ASCENDANCY of the acoustic physicists in the literature on the functional tests of hearing continues. We have tried to fit their ideas into office procedures within the facilities of the practicing otologist so far as we could.

The problem of shortened bone conduction and its relation to the indications for fenestration seems difficult, as it can occur even in tubal cases, for instance, if the round window is obstructed by secretion or the like.

HEARING AIDS

Guilford and Haug [1] discuss the problem of the otologist and the hearing aid. The ideal candidate for a hearing aid is one with an average loss of 30 db. or more in the better ear, absence of recruitment and tolerance problems for amplification, and a noninfected external canal, middle ear, or mastoid process. He should have satisfactory discrimination ability and be psychologically prepared to adjust to the associated early noise discomfort as well as the supposed stigma of wearing a hearing aid. Above threshold measurements of both pure tone and speech are necessary to properly evaluate a patient's ability to wear a hearing aid and determine the amount of benefit he can expect from its use. The factors to be considered are discrimination ability, presence of recruitment, and tolerance to loud sounds.

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Two tests are done to determine the discrimination ability. The speech reception threshold test (SRT) measures the hearing loss for speech. This test can be administered in a quiet room through the earphones with the use of the Harvard Spondee records W-1 or W-2. The lowest level of intensity is determined at which the patient can correctly identify 50% of the spondee words. The patient's ability to understand the spoken word is measured by the discrimination loss or PB Max test. The discrimination score is the maximum percentage of one-syllable phonetically balanced words repeated correctly at the most comfortable loudness level, which is usually 25 to 30 db. above the speech reception threshold. This test can be made through any good record player as long as the intensity is comfortably loud through the earphones. It can be administered in a quiet room with Harvard PB record W-22. The discrimination score is a practical measure of the nerve function of the person tested. These tests can also be done with the live voice.

Recruitment can be measured by noting the placement of most comfortable loudness and uncomfortable loudness curves in relation to threshold curves for pure tones. Where there is convergence or a narrowed range, recruitment is present. This is a simple technique requiring only a standard audiometer. Tolerance problems for amplified sounds are often found in the presence of recruitment.

For the hearing-aid evaluation these tests are repeated with the patient wearing the aid. Different aids or a master hearing aid are used which reproduce the chief characteristics of the major hearing-aid types. The important steps in hearing-aid rehabilitation

are, first, selecting the proper candidate, then, establishing optimum fitting characteristics, follow-up evaluation of newly published aids, and, finally, adjustment counseling and auditory training. The writers figure that the average cost of hearing-aid wear, figuring the use of two instruments over a period of five years, is approximately $150.00 a year. The hard of hearing are more open to exploitation by commercial interests than other groups of handicapped persons. This is due in part to the lack of proper professional supervision in the fitting of the hearing aid. To improve this condition the otologist must realize the limitations of the hearing aid and prepare himself and his facilities for selecting the proper candidates.

Koenig and Eichler [2] offer a new idea for a hearing aid for severe perception deafness, namely, the construction of a hearing aid which transposes incoming speech to a lower octave with magnification; thus the unpleasant sound magnification of higher frequencies is overcome. They claim that a practical instrument of this type can be constructed in pocket size.

HEARING TESTS

Hoople [3] discusses the evolution of modern office hearing tests. He emphasizes the importance of speech audiometry. This is of great value in making accurate diagnoses in determining whether a patient can satisfactorily wear a hearing aid and in testing for industry. Unfortunately, at present there are no standard recorded materials available for reporting percentage loss of hearing with speech audiometry. An attempt is being made to create tests which can be validated by other hearing examinations and known hearing experiences. It is estimated that it will be two years at least before such material can be properly assembled, recorded, and made available commercially. Speech audiometry is one of the significant methods of testing hearing, and indications are that it may soon become an integral part of all hearing evaluations.

Santamarina [4] describes the routine he uses in his office to diagnose and properly evaluate auditory disorders in adults. The special techniques for the preschool child are not discussed in this paper. A complete description of the various tests used is given. These include voice and tuning-fork tests, pure-tone and speech audiometry tests, and hearing-aid evaluation procedures. This is a very practical paper and should be of extreme interest to the practicing otologist who is interested in doing thorough, satisfactory work in audiology in his office.

Curry [5] presents a step-by-step procedure for audiometer pure-tone air-conduction threshold determination. There are slight modifications to a report he made previously. These additions are, essentially, check the audiometer before testing, test the better hearing ear first if that information is available, start the stimulus at a level of 60 db., vary the time variation of the stimulus presented, have the patient touch the earphone on the ear when the stimulus is heard, keep the stimulus on for longer than a second, and, finally, keep the patient alert. These simple practical points are made for the beginning testee. A reference to this article for those starting audiometry is suggested.

Corso [6] made a study on 90 normal volunteer subjects to evaluate operating conditions of a Reger model of the Békésy audiometer. The purpose of this study was to determine the effects of testing time and signal attenuation rate on three criterion measurements: threshold value at 1000 cps, variability of response above and below mean threshold value, and threshold reliability of test-retest audiograms. He found that the testing time and attenuation rate have no effect on mean threshold at 1000 cps, the attenuation rate has a significant effect on threshold variability, and the attenuation rate has a significant effect on test-retest reliability. He concludes that the optimal performance on the Békésy audiometer is obtained by using an attenuation rate of 0.5 db. per second combined with a total testing time of 5, 10, or 20 minutes.

Albrite and Glorig [7] report the use of a modified soft plastic insert which is fitted into the hearing-aid receiver. This was developed at the Audiology and Speech Correction

Center, Walter Reed Army Hospital. This tubeless soft insert replaces the previously used standard soft insert. It is more comfortable, takes less time to make, and costs less money.

Thompson [8] gives the results of a two-year demonstration of the hearing-conservation program in the Chicago public schools; 36,692 school children were tested in 98 Chicago public schools; 2.8% showed a loss of 30 db. or more for two or more frequencies between 256 and 892 and were referred for otological examination. The hearing loss was confirmed in 84% of those referred. There was a slightly lower incidence of impaired hearing in the underprivileged as compared with that of children from better socioeconomic backgrounds. Another interesting fact is that children from all-white neighborhoods showed a consistently higher evidence of hearing impairments, nearly twice as high, than did children from Negro areas. The weakest link in the program was the small percentage of the children who received follow-up examinations. Only 32.5% went to a doctor or a clinic, and only one in four of these was taken to an otologist, more of them being taken to a pediatrician or a general practitioner. The problem of getting the hearing-impaired child to an otologist appears to be one of education of the public. Analysis of the records to determine the results of medical treatment of the hearing showed no change in the majority of the children. Of those who showed improvement, 37% had medical care, while 63% had no care. Periodic hearing tests are very important in discovering mild and, at times, severe hearing impairments not recognized by either the parent or teacher. Fifty-four per cent of the cases having a loss of 35 db. or more for the speech frequencies were not aware of this loss, nor were their parents suspicious of any hearing difficulty. It is for this group that the greatest benefit can be gained from a school examination program with periodic testing of the hearing of all school children.

Wolferman [9] reports a case of congenital auditory aphasia in a 4½-year-old child. A diagnosis was made with the use of the psychogalvanic skin resistance test. Three causes of delayed speech have to be excluded before a diagnosis of congenital auditory aphasia can be made. These are mental retardation, hearing disabilities, and functional disturbances resulting from fear reactions or other emotional factors. Congenital auditory aphasia is much more frequent than is generally thought. About 70 cases have been reported in the literature, most of them before the use of psychogalvanic skin resistance tests. This test should be employed freely in young children with hearing and speech difficulties. It is especially dangerous to label a child mentally defective because he cannot talk or understand language and equally dangerous to consider these children as hopelessly deaf.

Heller and Ludenberg [10] report five cases of sudden perceptive deafness. All occurred in adult patients. Four developed bilateral deafness, which apparently is irreversible. One developed monaural deafness, which improved spontaneously. No etiological factors have been identified. Several possible mechanisms are offered as a possible hypothesis. These are blood sludging, a virus which has an affinity for neural tissue, and allergy.

Most workers with the hard of hearing have observed wide differences in lipreading ability. This ability does not appear to be closely correlated with general intelligence or the amount of lipreading instruction. Keaster [11] has outlined a study which will attempt to correlate such ability with specific psychological aptitudes and with projective tests of personality to get more information as to how to make lipreading instruction more effective for those people who have difficulty learning the art.

Adler [12] discovered a new middle-ear phenomenon consisting of noises emanating from the middle ear which are actuated by pressure waves from a Siegel otoscope. Certain types of noises are heard in all normal ears. By using special equipment he was able to record these noises. This may serve as a new method for the clinical examination of hidden middle-ear changes.

Maffei [13] investigated the effect of tobacco upon the ear. After a rapid survey of the general effects of tobacco upon the human system, the author outlines his own investigations with respect to the auditory results of smoking. Four groups of patients were studied: 15 cases of alcoholic-nicotine amblyopia referred from the ophthalmology department, 7 ambulatory patients with different grades of cochleovestibular disturbances of a type resulting from tobacco, 3 normal persons from a general medical standpoint but with vestibular disturbances of a type caused by tobacco, and 3 patients with signs of nicotine intoxication referred from other departments for cochlear and vestibular disturbances. Audiometric study revealed in all cases a typical perceptive hearing impairment. In most instances there was a positive recruitment sign indicative of a neuroepithelial lesion, and the majority of cases in this group also showed vestibular abnormalities. In cases which were considered to be of a central character, a toxic neuritis was diagnosed. A number of the milder cases were reversible, and those suggested a vascular origin. A test for differentiating between reversible peripheral and irreversible central lesions was used. After the patient abstained for 12 hours an audiogram was made and then the patient smoked two cigarettes. If the second audiogram showed an increased hearing loss, a peripheral lesion was diagnosed.

Maspétiol [14] contributes a discussion of the relationship between lowering of the threshold of discomfort and other alterations in suprathreshold hearing, notably recruitment and lowering of the difference limen. He considers that the threshold of discomfort is shown properly only by the psychogalvanic reflex; repeated tests will cause the disappearance of this reflex, but it will reappear at the same intensity level after a rest period. This level (SAI) is to be distinguished from the threshold of pain (SAD), which can be obtained by questioning the patient, there being a variable difference of 10-20 db. between the two thresholds. His investigations indicate that the commonly accepted view that alterations of suprathreshold hearing are present in cochlear deafness and absent in retrolabyrinthine deafness is subject to some modification. First of all, they can be found as an isolated phenomenon without lowering of the audiometric curve. Second, while very frequent in cochlear deafness, they are not a constant accompaniment; lowering of the threshold of discomfort or of pain or even absence of recruitment does not preclude a cochlear origin for a given deafness. On the other hand, some types of conduction deafness, especially certain tubal catarrhal affections, will show these alterations of suprathreshold hearing. He also finds that meningitis and arachnoiditis may give rise to either a cochlear or a neuritic type of deafness; in children, at least, those without lowering of the threshold of discomfort have neuritic deafness, which never regresses, while those who indicate a lowering of this threshold have cochlear deafness, which may regress. He believes that while all three of the tests mentioned generally indicate a cochlear deafness when present they must be interpreted in a critical spirit to be of value.

Perdoncini [15] calls attention to a fact noted by many otologists, namely, persons demonstrating the same audiometric curves may present sharp differences in their ability to hear speech. He quotes Lempert to the effect that "it is difficult to understand how an ear with a 60 db. loss of air conduction can understand speech better than one whose loss equals only 35-40 db." The author believes that cases of this type demonstrate the insufficiency of the two parameters used in pure-tone audiometry, i. e., frequency and intensity. Vocal audiometry, while valuable, is still not an exact measure because of the factors of education and psychology which influence the test. The author believes that a third parameter, duration of the sound, which he likens to the rate of flow in measuring electric power, should be considered in hearing tests. This is based on the fact that speech consists of a series of sounds of short duration lasting from a few milliseconds for vowels to 10-50 milliseconds for consonants. For this purpose an apparatus

which could produce sounds of varying short durations in the usual frequencies was devised and used for constructing audiograms. These were made using sounds of 15 milliseconds and employing trained observers. Their findings indicated that when the usual audiograms and the one with sounds of short duration are not parallel intelligibility for speech is affected.

Alagna and Berlendis [16] summarize the extensive literature on auditory fatigue and discuss their own clinical experiments in this field. They used 60 patients equally divided between normal, conduction deafness, and perception deafness cases. These were exposed, after the usual audiometric examination, in a sound-proof room to stimuli of 50 db. over threshold in the frequencies of 512, 1024, 2048, and 4096 kilocycles, lasting for five minutes. After another five minutes new audiograms were made. They found that in normal patients and those with conduction deafness threshold elevations after these stimuli were very low, while they reached 20-25 db. in patients with nerve deafness.

Manfredi [17] describes a new technique for measuring recruitment by means of the binaural loudness test. This involves the use of a single telephone receiver from which lead two rubber tubes with ear pieces to fit each ear. The apparatus is enclosed in a box and is so arranged that special valves can be opened and closed to allow for simultaneous or alternate exposures to different sounds. The author claims that the use of this device, which can be adapted to any standard audiometer, makes for easier and more accurate use of the binaural loudness balance test.

Parisse [18] undertakes to establish the audiometric value of tuning forks. Thirty patients with defective hearing were studied with both tuning forks and the audiometer. Frequencies of 256, 512, 1024, 2048, and 4096 were used and duration of hearing in seconds was noted for both air and bone conduction. A diagram was constructed in which on the ordinate the decibels were represented and on the abscissa the seconds of hearing for each frequency (in 5 db. steps and five second steps except for 4096, which was in one second steps on account of the short period of vibration of the tuning fork). For the tuning-fork examination the physician's hearing, which had previously been tested by the audiometer, was used as a criterion for the difference between the duration in seconds for each tuning fork heard by the patient. A stream of air was found effective for bone-conduction tests in perception deafness cases, but in conduction deafness when the difference exceeded 40 db. a shadow curve was obtained in all instances regardless of the method of excluding the opposite ear. In correlating the points obtained on the diagram mentioned above it was evident that an average curve (of correspondence between tuning-fork results and the audiometric results) could be drawn. This could be accomplished for practical purposes by simply drawing the curve manually. For scientific purposes using higher mathematics, Parisse made precise calculations to establish a ratio for the rate of decrement in decibels for each fork. These calculations are given in considerable detail in the article. He states that a reliable audiogram can be constructed for either air or bone conduction from tuning forks by a relatively simple calculation. The average error does not exceed 5 db. Even a relationship between the results of tuning-fork tests and expected ability to hear speech can be estimated, but, of course, this does not take into effect the discrimination factor. Parisse suggests that a series of tuning forks could be manufactured in such a way that the value in decibels of each second of decrement would remain constant and that this would make for simple and accurate audiograms.

Secretan [19] observes that while hearing tests have generally gained in precision bone-conduction tests, which should be very important from a diagnostic standpoint, they still offer problems which are far from being solved. Much more than the results of aid-conduction tests, the results of bone-conduction examination depend on technical considerations involving the force with which the bone oscillator is applied and where it is

placed; the personality of the examiner also plays a much greater role than in the examination of air conduction. Above all, the masking problem offers great difficulties, especially in asymmetric cases. In some cases of conduction deafness correct masking is impossible, as the intensity required would exert a masking effect upon the ear being examined. Illustrative audiograms are included.

Pestalozza [20] discusses auditory adaptation to strong sound stimuli and its practical application as a means of differentiating between different forms of deafness. There is a rapid survey of the physiology of auditory fatigue and adaptation and the difference between the two phenomena. The author follows the ideas and technique of Hood, who distinguished between poststimulatory fatigue, in which the threshold is determined before and after a stimulus of 90 db. or over to one ear, and perstimulatory fatigue, in which two audiometers are used: one applies a constant sound at a given intensity above threshold to one ear, while the other is used by the subject (employing an automatic recorder) to match the loudness of the sound in the first ear. Poststimulatory fatigue is not only a variable corresponding to the intensity and the frequency of the test stimulus but also differs considerably with different persons. In performing the perstimulatory test the author found, as Hood did, that after applying the stimulus for a given time (usually three minutes), stopping, and then reapplying a variable tone to the same ear a weaker stimulus than the initial one is required to match the original loudness in the other ear; this fatigue is subject to fairly uniform behavior in terms of duration, strength, initial constant stimulus, and frequency when applied to normal persons. The maximum reduction for normal persons and those with conduction deafness under these circumstances is never higher than 30%; the same rate shows a marked increase sometimes, reaching 100% in cochlear deafness, whereas retrocochlear deafness appears to behave like conduction deafness.

Michel and Claudine Portmann [21] give their experience with auditory tests employed in the examination of 500 children between the ages of 15 months and 8 years. These tests are listed as (*a*) tonal, such as ordinary audiometry, "peep-show" technique, psychogalvanic testing, and the sound of bells transmitted through a loudspeaker, and (*b*) vocal, including the presentation of phrases, intelligibility curve obtained through image tests, and reaction to names. Their conclusion is that a children's audiologist ought to possess room and equipment allowing for the performance of the greatest variety of tests, as several different kinds of tests are necessary to obtain a valid result even with children of normal intelligence, whatever the age. They found the greatest difficulty in subnormal children, in whom responses (even with the psychogalvanic test) may be small or nonexistent with any test, as well as in children with retarded speech. A sound-proof room is essential to obtain a true curve in the backward child without hearing loss, thus allowing for differentiation from the subnormal and speech-retarded children with auditory impairment.

Russbach [22] comments on some of the difficulties of bone-conduction tests. After a short discussion of the conventional concepts involving abnormalities indicated by air- and bone-conduction methods of studying hearing, the author presents three illustrative cases in which bone conduction failed to agree with accepted ideas. In mentioning the difficulties involved during the latter tests, Russbach quotes Békésy to the effect that bone conduction results from several mechanisms. In clinical tests the vibrations of the mandible play a role, while cranial bone conduction has a double mechanism involving displacement of the cochlear fluid by the vibrations of the ossicles as well as from the vibrations of the bony labyrinthine capsule; there is also a direct effect upon the labyrinth.

Hedgecock [23] describes the several characteristics of audition thought to be indicative

of recruitment and reviews the procedures employed in measuring these characteristics. He describes recruitment as a condition in which certain defective ears are more sensitive to changes of sound than are normal ears. It manifests itself in at least two ways: One is the sudden detection and distinct awareness of the threshold of sound in an ear with recruitment as compared with a gradual and uncertain onset of threshold in a normal ear. The other manifestation is that at succeeding levels above threshold the difference in loudness for a tone of given intensity between an ear with recruitment and a normal ear tends to diminish and disappear. The detection and measurement of recruitment has been used by otologists as an aid in diagnosing the types of deafness encountered, in testing the effectiveness of treatment, and in evaluating and selecting hearing aids. The tests that are advocated for the measurement of auditory recruitment may be grouped into four general types: (1) tests that compare and match the loudness of sounds, (2) tests of the difference limen for intensity, (3) tests of auditory fatigue and masking, (4) tests of speech reception and discrimination. Certain tests are more useful for some conditions, while another test may reveal more under different circumstances. While these tests are capable of determining with reasonable accuracy the relative sensitivity and loudness function of a given ear as compared with that of normal ears, much remains for the complete understanding of the underlying organic basis and of the entire clinical significance of auditory recruitment.

Harbert and Sataloff [24] discuss the clinical applications of recruitment and masking. An ear that recruits sound generally presents some of these symptoms: Sound distortion is probably hollow or fuzzy. Diplacusis may be present. Loud noises may produce discomfort, implying a lowered threshold of discomfort. The recruiting ear usually shows sharper and more definite audiometric endpoints. Variable hearing occurs specifically in labyrinthosis, unlike the subjective daily variations found in conductive and functional hearing losses.

The alternate loudness balance test is a practical method to determine recruitment. A recruiting ear indicates a lesion in the organ of Corti. It is not present in a lesion restricted to the neural pathway. If both lesions are present recruitment will probably be present if the proportion of hair-cell damage is greater than that of nerve-fiber involvement. If the reverse is true, then recruitment may not be present. Recruitment is not present in conductive losses, acoustic neuromas, and psychogenic hearing losses. It is generally not present in presbyacusis. It is present in Ménière's syndrome and postfenestration labyrinthosis until the hearing markedly improves or the pathology sufficiently extends into the neural pathways. Recruitment can be established by tests simple enough to be performed in an otologist's office and should be used routinely in patients with perceptive hearing loss. Its presence or absence in a patient whose clinical picture is otherwise inconclusive may help localize the predominant site of the pathology.

Masking of the better ear should be used for speech as well as pure-tone audiometry when there is a difference of 40 to 50 db. between the two ears. Eightly decibels is the maximum intensity of masking that can be used in the opposite ear without stimulating the tested ear, because 50 to 60 db. does not cross over, due to the attenuation across the head, and the first 30 db. that do are ineffective for masking. That is also the maximum level that most patients will tolerate comfortably. One obtains the degree of hearing loss measureable by masking the opposite ear by assessing the total perceptive loss of the masked ear and adding the attenuation across the head. In air-conduction measurements the attenuation across the head is about 60 db., and in bone-conduction measurements the attenuation is only a few decibels. The perceptive loss is assessed on the basis of residual bone conduction in the masked ear under conditions of masking.

Hood [25] stresses the importance of the physiological principles underlying the phenomena of adaptation both in the design of all audiometric tests of cochlear function and

in the interpretation of the results. The basic principle of the test involves sustained stimulation, which is unlikely to bring in to play the pathological adaptation of the sustained response which involves the elimination or even reversal of recruitment. The test is performed by first obtaining the threshold of hearing in the conventional manner with an interrupted tone. After this is determined the intensity of the tone is raised by 5 db. and applied continuously, the subject stating when it can no longer be heard. In the normal subject or one with conductive deafness the tonal sensation will persist indefinitely. In those with end-organ disease the sensation of tone disappears completely after five or six seconds. After a rest period of one minute or more the procedure is repeated, with the intensity of the tone raised successively by 5 db. at each test. With higher tonal intensities the persistence of sensation becomes progressively longer until eventually an intensity is reached which evokes a sensation of tone indefinitely. This final intensity is 25 to 30 db. above the threshold intensity, and this is the measure of the magnitude of the loss of sensitivity due to pathological adaptation. A test can also be done by first determining the threshold with the use of a pure-tone audiometer which has a tone interrupter switch with a build-up of the order of 30 milliseconds. The threshold is determined by increasing the intensity of the bone from a sublimal level at a rate of 2 db. per second and noting the intensity when the tone is first heard. When this threshold level is compared with the continuous tone threshold level there is very little difference, 2 to 3 db., in normal subjects or those with conductive deafness. However, in subjects with end-organ disease, Ménière's, the differences are very striking and considerably greater. These tests enable one to effect the important clinical diagnosis of deafness due to disease of the cochlear end-organs.

Palva [26] reviews the papers on perstimulatory adaptation and some factors affecting binaural simultaneous loudness balance judgment. A group of normal subjects tested for adaptation loss showed an average of less than 10 db. loudness level loss measured after three minutes of continuous stimulation. The adaptation loss was comparable to normal values in 18 cases of conductive deafness and in nine ears with nonrecruiting perceptive deafness. In 51 ears having recruiting perceptive deafness an abnormally large adaptation loss, 30 db. or more, was found in 14%. Abnormal loudness adaptation does not appear to be related to poor speech discrimination, and its occurrence is not so frequent as assumed earlier. When it does occur, it seems to be associated with recruiting perceptive deafness.

Walsh and Goodman [27] report four cases with central lesions demonstrating findings of very poor discrimination scores with relatively moderate threshold losses for pure tones. They feel that the relation between threshold loss and discrimination for speech does not differentiate between auditory lesions in the cochlea and those central to the cochlea. Their observations dictate considerable caution in interpreting very poor discrimination for speech associated with moderate threshold loss as being unrelated to central auditory lesions. This relationship also does not necessarily predict the presence of recruitment. Recruitment is characteristically absent in central lesions and remains as the only auditory sign which differentiates between cochlear and retrocochlear lesions.

Harris and associates [28] discuss the relationship of recruitment, pitch tests, and speech-tone discrepancies. This is an attempt to explain the real discrepancy exhibited by some people between hearing for speech and for pure tones. They find there is no simple existing relationship of loudness perception, pitch discrimination, and speech-tone discrepancies. These investigators propose some type of formula which might be of value in correlating these variables. Further research should be along these lines. It appears that the interrelationships rather than isolated variables will prove of theoretical and practical importance.

Kos [29] emphasizes the importance of auditory symptoms and findings associated with

dizziness. Auditory impairment and some of the peculiarities associated with it, such as recruitment and threshold fatigue, are often helpful in making a diagnosis. The hearing loss of Ménière's disease is the inner-ear type, usually unilateral, involving early principally the low tones. There is a fluctuation of hearing acuity during its initial phases. Recruitment is present and severer for the higher frequencies than for the low. In labyrinthine ischemia the hearing loss is the high-frequency inner-ear type with or without recruitment. It is usually bilateral. The hearing loss in labyrinthine apoplexy is usually unilateral and quite severe, when measurable recruitment may not be present. In the acoustic neuroma and central lesions evidences of threshold fatigue may be present. The hearing-loss pattern is not characteristic, usually showing a non-middle-ear type of impairment with no recruitment. Speech discrimination tests reveal very poor appreciation responses. The auditory function is frequently a very important clue to the definition of dizziness.

Goodhill [30] has employed surgical audiometry in stapedolysis, to detect threshold shifts following manipulation of the incudostapedial mass. The test is made at four specific steps in the surgical procedure. A routine threshold sweep for four frequencies is made at 500, 1000, 2000, and 4000 cycles. A sterile sheet is placed over the operative field and the receiver held over the ear by the surgeon or scrub nurse with a sterile towel. The patient uses a push button for response signaling. The first-step test is made after the flap has been raised and the drum enucleated from the tympanic sulcus and then replaced to the original position. The second test is made immediately after the first test by simply reopening the middle ear by rolling the annular flap and posterior half of the tympanic membrane back over the anterior half. The third-step test is made upon completion of the lysis maneuver through the incudostapedial mass. This may involve several maneuvers, and the test is done when the surgeon feels that sufficient motion has been produced to expect some change. A threshold shift of at least 15 db. is usually considered significant. However, a shift of 20 to 25 db. is more commonly encountered in successful stapedolysis maneuvers. Step 4 is performed when the drum and auricular flap are replaced, as in Step 1, and a comparison is made between the two. In the most successful stapedolysis cases a threshold shift of 25 to 35 db. will be seen in at least two of the three lower frequencies. These findings, however, will be different when postoperative tests are made following healing and disappearance of edema. There will usually be an improvement of 10 to 20 db. in the speech range. These threshold determinations are relative and are made for comparative purposes only. These tests have shown interesting things. There is a threshold shift and hearing improvement at 4000 cycles of 10 to 25 db. in the majority of cases when the middle ear is opened. This disappears after successful stapedolysis. The lower three frequencies may change very slightly or drop 10 to 15 db. in Step 2. A drop of blood in the round-window niche may produce a phase shift change, temporarily lowering the hearing. These tests give a reliable method for determining threshold shifts to indicate progress in the surgical manipulation and effective performance of stapedial mobilization surgery.

Correct writing of the audiogram in absolute threshold values instead of drawing the usual hearing-loss curves simplifies masking problems and makes possible the comparison of the calibrated masking noise intensity with the intensity of the test sound.[31] Overhearing by bone conduction attenuates the sound energy by 10 to 20 db. Bone-conduction overhearing of low frequencies is increased by covering the ear with the normal earphone and exists also during use of the air-conduction telephone at intensities of 60 db. and more above threshold.

In perception deafness the intensity of masking noises for bone-conduction tests is the same or slightly louder than air-conduction threshold of the poorer ear. In conduction deafness it is more complicated. It is advisable to begin testing without masking; the ear with better bone conduction is then

masked. Masking intensity depends on air-conduction curves of the better ear and bone-conduction curve of the poorer ear (under test). Each case needs careful individual analysis to avoid overmasking by stimulating the ear under test by too intense masking of the nonexamined ear.

A speech reception threshold test for children is presented by Siegenthaler, Pearson, and Lesak.[32] After a child is taught to recognize by name illustrations of common objects, such as bread, bear, show, car, chair, etc., these words are repeated in measured intensity by a loudspeaker and the child points to the object named, thus indicating at what intensity he understood the word. The authors have succeeded with this test with 4-year olds. They claim this test meets the criteria of an acceptable speech threshold for children and has a high correlation with pure-tone average hearing loss for a group of children.

Luescher and Koenig [33] suggest that while accurate bone-conduction tests of each ear with exclusion of the other by noise are difficult in audiometric testing they are, nevertheless, superior to tuning-fork tests for this purpose (with a properly constituted audiometer). One of their illustrations shows the bone "knocker" applied on the forehead; this, together with the two ear pieces and the spring holding them, is held in place by a wide rubber band, which is worn around the head. If one has not the proper facilities for this, one must revert to using tuning forks, but they look upon this practice as retrogressive.

Dealing with "beats," Matzker [34] states that two sounds of different frequencies heard at the same time produce the phenomenon of "beats." If they have the same intensity, the sound seems completely interrupted at regular intervals. Beats are observed only when both sounds are heard in one ear. Calibration of forks and audiometers is never mathematically exact, so beats are produced between audiometer tone and the corresponding tone of the fork. As the fork attenuates there will be a moment when "knocks" are heard. At this moment the real difference in intensity corresponds to the loss of energy through (or around) the skull. This is independent of the frequency and general intensity of the sound. For bone conduction the loss is between 15 and 20 db., generally 20 db. For air conduction the loss is about 60 db.

Harris and Myers [35] state that variation of the absolute threshold over a five- to seven-minute period is slightly less than 1 db. For periods of hours to days to weeks standard variations are 1.17 to 2.96 db. Threshold variation is independent of air *vs.* bone conduction; 8192 cps was most influenced by lapse of time.

Schroeder [36] states that 300 diabetics audiometrically examined showed no disturbance of hearing attributable to the diabetes.

Gisselsson and Richter [37] experimented on animals by closing the round window with tooth cement and then measured the cochlear potentials, which were found to be reduced in amplitude.

Meurman and Meurman [38] ask if the semicircular canals play a part in directional hearing. Patients were tested in a sound-proof room with a loudspeaker. Each was placed with the head in four different planes in relation to the loudspeaker. Normal persons and unilaterally and bilaterally fenestrated patients were tested. The conclusion was that the ampullar end-organs probably played a part in directional hearing.

Jacho [39] states that the greater loss of hearing is contralateral to the cerebral lesion, the audiogram is characteristically parabola-shaped, and hearing fatigue is easily induced. There is an increase in the intensity limen difference.

The measurement of impedance may be used as an objective determination of hearing by use of an instrument and method described by Thomsen.[40] This is really an article for the acoustic physicist but is mentioned here for the information of the practicing otologist who may be interested in reading it in full.

An evaluation based on the social condition of hearing in 5000 persons was undertaken by Bentzen and Jelnes.[41] Beasley's

method of investigation was used, and by interviewing the patients in three hospitals in one county the social history of each informant and members of his family was obtained. The authors believe it is a representative cross section of the community; 1569 persons were interviewed regarding the 5000. Indications were that 407 people were suffering from impaired hearing at some time.

Palvo and Ojala,[42] of Turku, Finland, made an investigation of bone conduction in middle-ear pathology of various types. Reference measurements were made in 18 normal ears, and bone-conduction thresholds were ascertained in a series of 42 ears with catarrhal or purulent otitis media, before and after myringotomy and aspiration, and after healing. The majority of the cases showed normal bone-conduction values throughout the tests, while in the minority the initially lowered bone conduction improved with healing. The absence of recruitment suggests that even a temporary toxic inner-ear lesion is not probable. The amount of fluid aspirated from the tympanic cavities was not related to the changes in bone-conduction thresholds. It is concluded that in certain cases of conductive deafness, and especially in adhesive otitis, the lowered bone-conduction values do not necessarily indicate true perceptive deafness but are due to impaired mobility at the oval and round windows.

The tests were made in an acoustically treated double-walled room, and air receivers were held on the ears in all tests to obviate so far as possible such extraneous noise as might be present. In addition, the subjects all had conduction deafness to begin with.

Meurman,[43] of Helsinki, Finland, contributed an important observation useful in the diagnosis of neural deafness. He reports the results in 52 normal ears; 21 patients with conduction deafness, of whom 18 had otosclerosis; 19 patients with Ménière's disease; 19 young persons with neural deafness, and 28 old people with neural deafness. His conclusion is that in neural deafness, including Ménière's disease, the difference limen of frequency increases as the tones go higher, being especially marked at 2000 cps and above. An important finding was that in otosclerosis with shortened bone conduction this did not occur. In the difference limen of intensity, on the other hand, the figures diminish in lesions of Corti's organ as the cycles per second increase. In many of the cases of Ménière's disease the decrease in difference limen of intensity did not appear till 500 or 100 cps, while the difference limen of frequency showed a rise as early as 125 and 250 cps.

In an article too long and intricate for abstracting that Roesler and Lundberg[44] presented before the German Otolaryngological Congress, the authors cover, among other items, the following tests: voice index; monaural and binaural loudness balance; intensity limen difference; frequency limen difference; masking with pure tones and with noise; adaptation test with short and long (fatigue) stimuli; diplacusis; localization of sound; determination of shortest sound recognition; measurement of acoustic impedance; examination of cochleociliary reflexes; speech audiometry possibilities.

These examinations are useful in the diagnosis of angle tumors and Ménière's disease; prognosis in otosclerosis; fitting of hearing aids; auditory training in children with impaired hearing; recruitment investigations in traumatic deafness.

In an 81-page supplement to the *Acta otolaryngologica*, Bengt Barr[45] deals with "Pure Tone Audiometry for Pre-School Children." He states that pure-tone audiometry could be carried out in about three-fourths of the children between the ages of 4 and 6. In children under 4 years the examinations were not successful. In many cases it had a definite value in diagnosis. In children with no response to sound it gave no further information than was obtained in the preliminary hearing examination.

Play audiometry, a combination of pure-tone audiometry and Ewing's so-called toy test, is preferred by the author to the psychogalvanic skin reaction. Both require that the child possess a certain degree of mental development, although the psychogalvanic skin reaction may be useful in those at a

younger age. However, it is unpleasant and requires more time and personnel. The author reserves it for cases where play audiometry has failed or, because of the child's age, may be expected to fail. The article is well documented.

In a paper read before the 12th Nordic Otolaryngological Congress, Palva,[46] of Turku, Finland, deals with masking in audiometry. He states that the ordinary audiometric masking noise consisting of one basic frequency with a great number of overtones does not give satisfactory results; the interaction between the test tone and the masking note may result in a large dispersion of the masked thresholds. The attenuation across the head for air-conducted sounds in monaurally deaf persons is shown to be 50-55 db. with average-size receivers covering both ears and about 60 db. if the opposite ear is kept open. The tones are transmitted via bone conduction to the opposite ear. White noise is suggested for general use in masking because of its efficiency and predictability. Practical examples are given.

A contribution to the study of cross hearing, or hearing over, is made by Langenbeck.[47] Cross hearing occurs when the acoustic insulation between the ears is incomplete. The study was made by a special masking method. The results depend on the coupling between the earphone and the ear. Accurate masking of the better ear is discussed.

The accuracy of continuous audiometry as compared with that of octave audiometry is discussed by van der Waal and van Dishoeck.[48] Under favorable conditions, with an experienced operator, the average error in continuous audiometry is less than in octave audiometry. In addition, continuous audiometry provides more exact information of the total pattern of hearing loss.

ACOUSTIC TRAUMA

Glorig and Wheeler[49] present briefly the psychophysics of the ear in relation to noise. They define noise as an unwanted sound which should always be measured in two dimensions, intensity level and frequency. The hearing loss produced by noise is an irreversible nerve-type loss. The only information available on the subject of noise-induced hearing loss is found in the reports of interested physicians. The physician is the final authority on these questions. His clinical experience and judgment are extremely important. He must know the facts about industrial noise exposure. When involved at the medicolegal level, he must know the amount, type, characteristics, and the duration of the noise the patient has been exposed to. Hearing conservation should be the guiding principle of the industrial physician, hygienist, and safety engineer. Adequate equipment is available now for measuring hearing and noise and should be utilized in this program. Very able and active committees have been organized by the various societies and the armed forces to study these respective problems.

McLaurin[50] stresses the need for the otologist to concern himself with the medicolegal implications of loss of hearing from industrial noise. This problem is a major economic and legal one. An appalling fact is that hundreds of thousands of employees who work in a noisy environment and may have suffered loss of hearing as a result do not have any audiometric hearing tests. Diagnosis is by audiometry. The otologist should be certain of the exact calibration of his audiometer at the time the test is done, and he must be able to defend his findings when called upon to do so. The evaluation of the results has been unsatisfactory. The formula recommended by the Committee on Physical Medicine of the American Medical Association is open to several criticisms. It does not take into account the social loss. The rapid calculator devised by Kinney,[51] derived from the tables recommended by the A. M. A., is the simplest and fastest method presently available. Preventive measures include changes in plant construction, proper treatment of machinery, personal protection of the worker by wearing ear plugs, etc., and audiometric testing of all new employees. These employees should have repeated audio-

grams at regular intervals as long as they work in a traumatic environment. Therapy is entirely rehabilitative, since the resulting nerve damage is irreversible.

Sataloff [52] discusses the problem of occupational hearing loss. He describes and illustrates various types of this condition. An interesting point demonstrated is the loss of hearing produced by some industrial noises which may produce severe temporary hearing loss in the lower frequencies below 4000 cps without showing any significant loss in the higher frequencies. This type is important because it selectively involves the frequency range for hearing speech. The usual occupational deafness produces the difficulty in understanding speech rather than hearing it. This is due to the difficulty in discriminating consonants because of the high-tone loss. This should be specifically looked for, especially in evaluating a handicap resulting from such a loss. The social, psychological, and vocational repercussions frequently resulting from occupational deafness should also be seriously considered, although they are not a primary concern of industry under the present compensation law. Occupations which may affect the hearing of exposed personnel are boiler making, weaving, aircraft maintenance, blacksmithing, chipping, riveting, blasting, gun firing, metal working, and others utilizing large machinery and high-pressure steam. The writer also lists the more essential elements of a conservation of hearing program. The importance of careful testing is emphasized as well as doing two or three independent audiograms consistent with each other for essential data. Otologists should acquire a clearer perspective of the many facets of occupational deafness and be aware of the unsolved problems in this field so as to be able to give good consultant advice when called upon to do so. The otologist has a major role in keeping the situation under control in practically all the important aspects concerning industrial deafness until definitive criteria are established to clarify the problems concerning this condition.

Fox [53] reviews the industrial noise problem as it has developed in the state of Wisconsin. Wisconsin has demonstrated its leadership in dealing with industrial hazards. It had the nation's first effective state compensation law, in May, 1911. He presents the recommendations of the subcommittee for determining and handling compensation losses of hearing loss from industrial noise. As an otologist, however, he feels that our efforts should still be primarily directed toward hearing conservation, so as to prevent these hearing losses and the liability to employers.

Saltzman and Ersner [54] report two cases of acoustic trauma with a unique symptom complex suggestive of a circumscribed lesion in the organ of Corti. The findings are a wedge-like defect in the audiogram and tinnitus aurium which compares precisely in frequency and intensity with the apex of the notch. Diplacusis is frequently found. The existence of an extremely low threshold of discomfort, most pronounced for the high tones, was found in these cases. An irritating sound intensified the tinnitus to a marked degree. Three types of acoustic trauma are described: the insidious and slowly progessive type, which results from exposure to excessive noise over a period of years; the sound-injured inner ear which follows a brief exposure to the detonation of a cannon or rifle, producing the wedge-like high-frequency loss, tinnitus, diplacusis, and a marked lowering of the threshold of discomfort; progressive degeneration after sound injury even without further exposure to noise. Patients with this latter type should be guarded against infections, cochlea-toxic drugs, avitaminosis, and exposure to noise.

25 E. Washington St.

REFERENCES

1. Guilford, E. R., and Haug, C. O.: The Otologist and the Hearing Aid, A. M. A. Arch. Otolaryng. **61**:9 (Jan.) 1955.

2. Koenig, G., and Eichler, H.: Ein neues Verfahren zu Höhrenbesserung bei Hochgraediger Perceptions Schwerhoerigkeit durch Horapparat, Arch. Ohren- Nasen- u. Kehlkopfh. **165**:326, 1954.

3. Hoople, G. D.: The Evolution of Modern Office Audiometry, Ann. Otol. Rhin. & Laryng. **64**:79 (March) 1955.

4. Santamarina, F. G.: Practical Office Audiology, A. M. A. Arch. Otolaryng. **61**:437 (April) 1955.

5. Curry, E. T.: Threshold Finding in Pure Frequency Audiometry, A. M. A. Arch. Otolaryng. **61**:394 (April) 1955.

6. Corso, J. F.: Evaluation of Operating Conditions on a Békésy-Type Audiometer, A. M. A. Arch. Otolaryng. **61**:649 (June) 1955.

7. Albrite, J. P., and Glorig, A.: Modified Soft Ear Insert, A. M. A. Arch. Otolaryng. **61**:328 (March) 1955.

8. Thompson, M. L.: Results of a 2-Year Demonstration of the Hearing Conservation Program in the Chicago Public Schools, Tr. Am. Acad. Ophth. **59**:175 (March-April) 1955.

9. Wolferman, A.: Congenital Auditory Aphasia, A. M. A. Arch. Otolaryng. **62**:509 (Nov.) 1955.

10. Heller, M. F., and Ludenberg, P.: Sudden Perceptive Deafness, Ann. Otol. Rhin. & Laryng. **64**:931 (Sept.) 1955.

11. Keaster, J.: An Inquiry into Current Concepts of Visual Speech Reception, Laryngoscope **65**:80 (Feb.) 1955.

12. Adler, H. J.: A New Middle Ear Phenomenon, Eye, Ear, Nose & Throat Month. **34**: 244 (April) 1955.

13. Maffei, G.: Tobacco Intoxication of the Ear: Value of the Nicotine Abstinence Test, Arch. ital. laring. **62**:235 (July-Aug.) 1954.

14. Maspétiol, R.: Lowering of the Threshold of Uncomfortable Hearing and Alterations in Suprathreshold Hearing, Acta oto-rhino-laryng. belg. **8**: 218, 1954.

15. Perdoncini, G.: Duration, a New Parameter in Audiology, Acta oto-rhino-laryng. belg. **8**:236, 1954.

16. Alagna, E., and Berlendis, P. A.: The Fatigue Phenomenon in Various Types of Deafness, Oto-rino-laring. ital. **22**:118, 1954.

17. Manfredi, A.: A New Procedure for Measuring Recruitment by Detecting the Equality of Loudness, Valsalva **30**:129, 1954.

18. Parisse, J.: The Audiometric Value of Tuning Forks, Ann. oto-laryng. **71**:67, 1954.

19. Secretan, J. P.: Some Remarks on Bone Conduction, Pract. oto-rhino-laryng. **16**:333, 1954.

20. Pestalozza, G.: The Practical Value of the Adaptation Test in the Differential Diagnosis of Deafness, Arch. ital. otol. **64**:855 (Nov.-Dec.) 1953.

21. Portmann, M., and Portmann, C.: An Evaluation of Various Audiometric Tests in Children, Rev. laryng. **74**:581, 1953.

22. Russbach, A.: Some Cases of Discord Between Hearing by Bone and Hearing by Air Conduction in Audiometry, Pract. oto-rhino-laryng. **16**:328, 1954.

23. Hedgecock, L. D.: The Measurement of Auditory Recruitment, A. M. A. Arch. Otolaryng. **62**:515 (Nov.) 1955.

24. Harbert, F., and Sataloff, J. A.: Clinical Applications of Recruitment and Masking, Laryngoscope **65**:113 (March) 1955.

25. Hood, J. D.: Auditory Fatigue and Adaptation in the Differential Diagnosis of End-Organ Disease, Ann. Otol. Rhin. & Laryng. **64**:507 (June) 1955.

26. Palva, T.: Studies on Per-Stimulatory Adaptation in Various Groups of Deafness, Laryngoscope **65**:829 (Sept.) 1955.

27. Walsh, T. E., and Goodman, A.: Speech Discrimination in Central Auditory Lesions, Laryngoscope **65**:1 (Jan.) 1955.

28. Harris, J. D.; Haines, H. L., and Myers, C. K.: Recruitment, Pitch Tests, and Speech-Tone Hearing Discrepancies, A. M. A. Arch. Otolaryng. **62**:66 (July) 1955.

29. Kos, C. M.: Auditory Function as Related to the Complaint of Dizziness, Laryngoscope **65**: 711 (Aug.) 1955.

30. Goodhill, V.: Surgical Audiometry in Stapedolysis, A. M. A. Arch. Otolaryng. **62**:504 (Nov.) 1955.

31. Langenbeck, B.: The Problem of Masking, Ztschr. Laryng. Rhin. Otol. **33**:527 (Sept.) 1954.

32. Siegenthaler, B. M.; Pearson, J., and Lesak, R. J.: A Speech Reception Threshold Test for Children, J. Speech & Hearing Disorders **19**:360 (Sept.) 1954.

33. Luescher, E., and Koenig, E.: Die vertaubung des Gegenohres bei der Audiometrischen Bestimmung der Knochenleitung, Arch. Hals-Nasen- u. Ohrenh. **168**:68, 1955.

34. Matzker, J.: A New Method of Measuring the Endocranial Overhearing, Ztschr. Laryng. Rhin. Otol. **33**:619 (Oct.) 1954.

35. Harris, J. D., and Myers, C. K.: Experiment on Fluctuating Auditory Acuity, J. Gen. Psychol. **50**:87, 1954.

36. Schroeder, H.: Does Diabetic Deafness Exist? Ztschr. Laryng. Rhin. Otol. **33**:498 (July) 1954.

37. Gisselsson, L., and Richter, O.: Contribution to the Problem of Hearing After Closure of the Round Window, Arch. Ohren- Nasen- u. Kehlkopfh. **166**:410, 1955.

38. Meurman, Y., and Meurman, O. H.: Do the Semicircular Canals Play a Part in Directional Hearing? Acta oto-laryng. **44**:542 (Sept.-Dec.) 1954.

39. Jacho, H.: Contribution to the Audiometric Diagnosis of Central Deafness, Arch. Ohren-Nasen- u. Kehlkopfh. **165**:331, 1954.

40. Thomsen, K. A.: Employment of Impedance Measurements in Otologic and Otoneurologic Diagnostics, Acta oto-laryng. **45**:159 (March-April) 1955.

41. Bentzen, O., and Jelnes, K.: Incidence of Impaired Hearing in Denmark, Acta oto-laryng. **45**:189 (May-June) 1955.

42. Palvo, T., and Ojala, L.: Middle Ear Conduction Deafness and Bone Conduction, Acta oto-laryng. **45**:137 (March-April) 1955.

43. Meurman, O. H.: The Difference Limen of Frequency in Tests of Auditory Function, Acta oto-laryng. **44**: (Supp. 118) 144, 1954.

44. Roesler, G., and Lundberg, T.: Recruitment and Its Associated Symptomatology in Technical and Clinical Approach, Arch. Ohren- Nasen- u. Kehlkopfh. **166**:159 (Oct.) 1954.

45. Barr, B.: Pure Tone Audiometry for Pre-School Children, Acta oto-laryng., Supp. 121, p. 1, 1955.

46. Palva, T.: Masking in Audiometry, Acta oto-laryng. **44**: (Supp. 118) 156, 1954.

47. Langenbeck, B.: Cross Hearing, Acta oto-laryng. **44**:462 (Sept.-Dec.) 1954.

48. Waal, J. van der, and Dishoeck, A. H. A. van: The Accuracy of Continuous Audiometry as Compared with Octave Audiometry, Pract. oto-rhino-laryng. **17**:45, 1955.

49. Glorig, A., and Wheeler, D. E.: An Introduction to the Industrial Noise Problem, Illinois M. J. **107**:10 (Jan.) 1955.

50. McLaurin, J. W.: Otologic Considerations of Noise in Industry, Eye, Ear, Nose & Throat Month. **34**:175 (March) 1955.

51. Kinney, C. E.: Lectures on the Acoustical Spectrum: Sound—Wanted and Unwanted, Ann Arbor, Mich., University of Michigan Press, 1952, pp. 86-89.

52. Sataloff, J.: Occupational Hearing Loss, Eye, Ear, Nose & Throat Month. **34**:105 (Feb.) 1955.

53. Fox, M. S.: The Wisconsin Story of the Industrial Noise Problem, Noise Control **1**:74 (Jan.) 1955.

54. Saltzman, M., and Ersner, M. S.: Acoustic Trauma, A. M. A. Arch. Otolaryng. **62**:235 (Sept.) 1955.

Books

Tendances évolutives de la fenestration (Evolutionary Tendencies of Fenestration Operation). By M. Sourdille in collaboration with R. David de Sanson, G. Ferreri, L. Ruedi, A. Sercer, and G. E. Shambaugh. Price, 850 francs. Pp. 168, with 13 illustrations. Masson & Cie, 120 boulevard Saint-Germain, Paris, 6e, 1955.

This monogram reviews the evolution of the fenestration operation, and the authors have indicated the progress of this operation. Separate chapters deal with the progress in (1) France, (2) the Anglo-American countries, (3) the German and Northern countries of Europe, (4) the Spanish-speaking countries, (5) the Italian-speaking countries, and (6) the Slavic countries. The analysis and reports of the various operations by the various surgeons in each of the countries indicate not only the techniques but the results that are obtained throughout the world. In the last chapter Sourdille more or less reviews the present tendencies in dealing with otosclerosis. He indicates that there are three standard techniques and stresses the importance of the follow-up care; he believes that satisfactory results can be obtained between 70%-90% of the cases. These depend upon (1) the proper indication for operation and (2) the dexterity of the operator. Lastly, he believes that it is important to continue research for the possible genesis of otosclerosis, and, if possible, to establish some prophylactic measures against its recurrences and progress. This book is an excellent summary of the progress of fenestration throughout the world.

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This report presents a series of original articles in otolaryngology. They cover the entire field of otolaryngology and many related problems, such as the examination of a deafened infant; tumors of the palate; acoustic tumors; otologic sequelae of cranial tumors; malignant granuloma; cholesteatoma of the ear; indications of radium therapy and surgery of the ear, nose, and throat, and otitic mastoiditis in infants. Furthermore, there are original articles on the embryology of the cochlear vestibular apparatus, constitution and dynamics of the fluids of the internal ear, new considerations and physiology of phonation. Finally, there are papers on the treatment of temporomaxillary ankylosis; osteomyelitis of the dental centers; esophageal dysphagias in cancer; technique, indications, and results in surgery of the esophagus, and, finally, radioactive isotopes.

While some of these articles have been previously published in other journals, this is an excellent collection of articles on timely subjects and makes them available in a single volume.

Die Schallsonde (Tone Sound). By Alfred Thullen. Price, DM 13 ($3.10). Pp. 76, with 72 illustrations. Georg Thieme Verlag, Herdweg 63, (14a) Stuttgart, 1955.

The author presents a monogram describing the use and implication of an apparatus which was originated by Zollner called the "tone sound." This has a long curved fine metal sound which is connected to a small magnetic receiver which, in turn, is connected to an audiometer. The sound is placed in various locations of the tympanic membrane or middle-ear cavity; the tones are generated from the audiometer and the patient responds to the perception of these tones. The author indicates that with the use of the tone sound he is able to differentiate many lesions involving the various portions of the sound-conducting mechanism. He has been able to determine the mobility of both the oval and round windows, and it has been of value to him in determining the specific type of tympanoplasty that would help restore the hearing to an appreciable level. The monogram contains a detailed description and the technique of using the tone sound, with the results and interpretations of preoperative cases as well as those of postoperative cases. The author feels that this apparatus has been of extreme value to him in localizing the source of pathology.

38. Meurman, Y., and Meurman, O. H.: Do the Semicircular Canals Play a Part in Directional Hearing? Acta oto-laryng. **44**:542 (Sept.-Dec.) 1954.

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Chirurgie des glandes salivaires (Surgery of the Salivary Glands). By Henri Redon. Cardboard, 2300 francs; cloth, 2900 francs. Pp. 282, with 77 illustrations. Masson & Cie, 120 boulevard Saint-Germain, Paris, 6e, 1955.

This is one of the series of surgical monograms from the collection of Henri Modor. It is presented more or less in lecture form. The first chapter deals with traumatism in the parotid region and its sequelae. Also discussed are traumatism of the gland and its excretory duct, fistulas of the parotid, preparotid fistulas, and extrapetrous facial paralyses and their treatment.

The second chapter deals with parotid tumors. There is an anatopathologic discussion of the various types of tumors that may occur in this region, such as mixed tumors, recurrent mixed tumors, hemolymphangiomas, lipomas, and schwannomas. Here, too, the pathology, diagnosis (including roentgen studies), treatment, and prognosis are all included. Under treatment the author describes his technique for the excision of the parotid gland. Cystic adenolymphomas, parotid adenomas, parotid cysts, cylindromas, and glandular cancers are all discussed from the standpoint of histology, symptomatology, diagnosis, prognosis, and treatment.

The third chapter deals with the various types of parotiditis: acute, chronic, and those associated with various systemic diseases. The etiology of each group and the specific treatment for each, where possible, are indicated.

The fourth chapter deals with the surgery of the submaxillary gland, which is concerned with pathology due to calculi or malignancies.

The fifth chapter deals with salivary tumors and adjacent glands, particularly the sublingual.

There is an extensive bibliography. This book is very timely and important in that there has been no recent comprehensive evaluation of this important subject.

Directory of Otolaryngological Societies *

FOREIGN AND INTERNATIONAL

Canadian Otolaryngological Society
(Société Canadienne d'Otolaryngologie)

President: Dr. D. S. Gorrell, 110 Medical Arts Building, Calgary, Alta.

Secretary: Dr. G. Arnold Henry, 328 Medical Arts Building, Toronto.

Place: Chateau Frontenac, Quebec, Canada. Time: June 6-7, 1956.

International Bronchoesophagological Society

President: Dr. Antonio da Costa Quinta, Lisbon, Portugal.

Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.

Meeting: Fourth International Congress of Bronchoesophagology.

President of Congress: Dr. Antonio Carrascosa.

International Congress of Audiology

Place: Leyden, Netherlands.

General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Netherlands.

International Course in Paedo-Audiology

Place: Groningen, Netherlands.

General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Netherlands.

Pan-American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

President: Dr. Juan Manuel Tato, Azcuenaga 235, Buenos Aires, Argentina.

Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.

Sixth International Congress of Otolaryngology.

President: Dr. Arthur W. Proetz, 3720 Washington Blvd., St. Louis.

General Secretary: Dr. Paul H. Holinger, 700 N. Michigan Ave., Chicago 11.

Place: Hotel Statler, Washington, D. C. Time: May 5-10, 1957.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. John R. Lindsay, Chicago.

Secretary: Dr. Hugh A. Kuhn, 112 Rimbach St., Hammond, Ind.

Place: Chicago. Time: June 11-15, 1956.

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President: Dr. Algernon B. Reese, 73 E. 71st St., New York 21.

Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave., Bldg., Rochester, Minn.

American Board of Otolaryngology

President: Dr. Frederick T. Hill, Professional Building, Waterville, Maine.

Secretary-Treasurer: Dr. Dean M. Lierle, University Hospitals, Iowa City.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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AMERICAN LARYNGOLOGICAL ASSOCIATION

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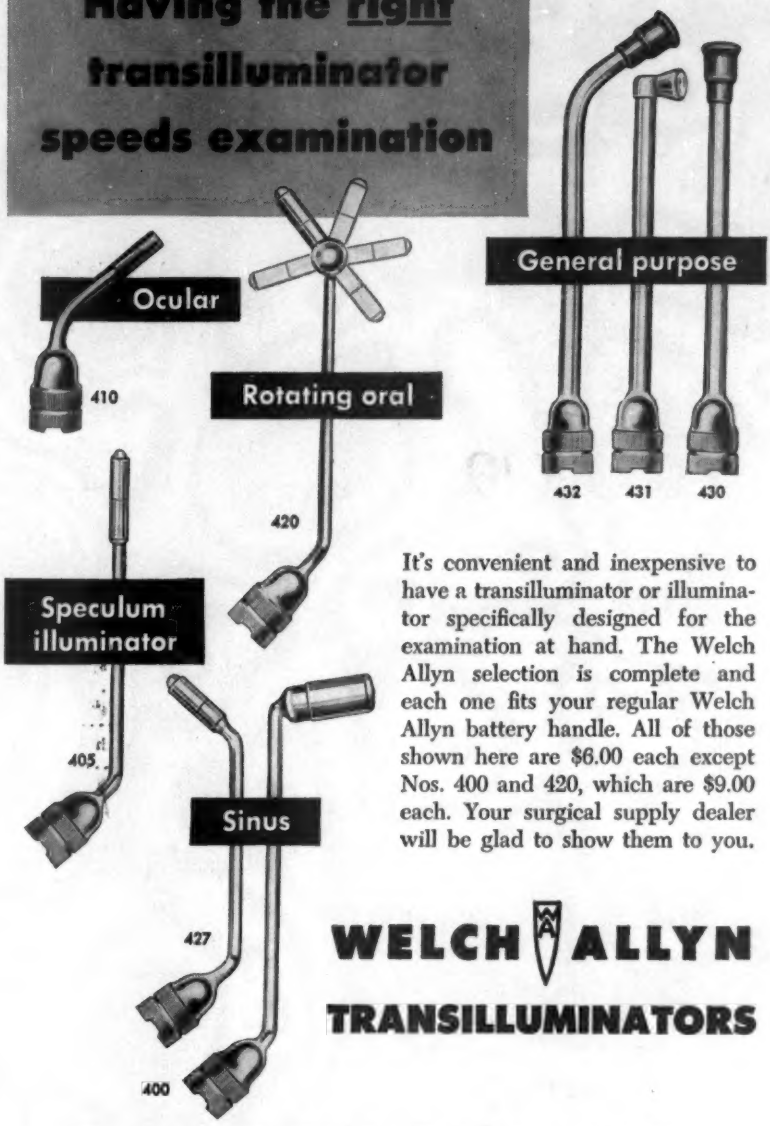

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